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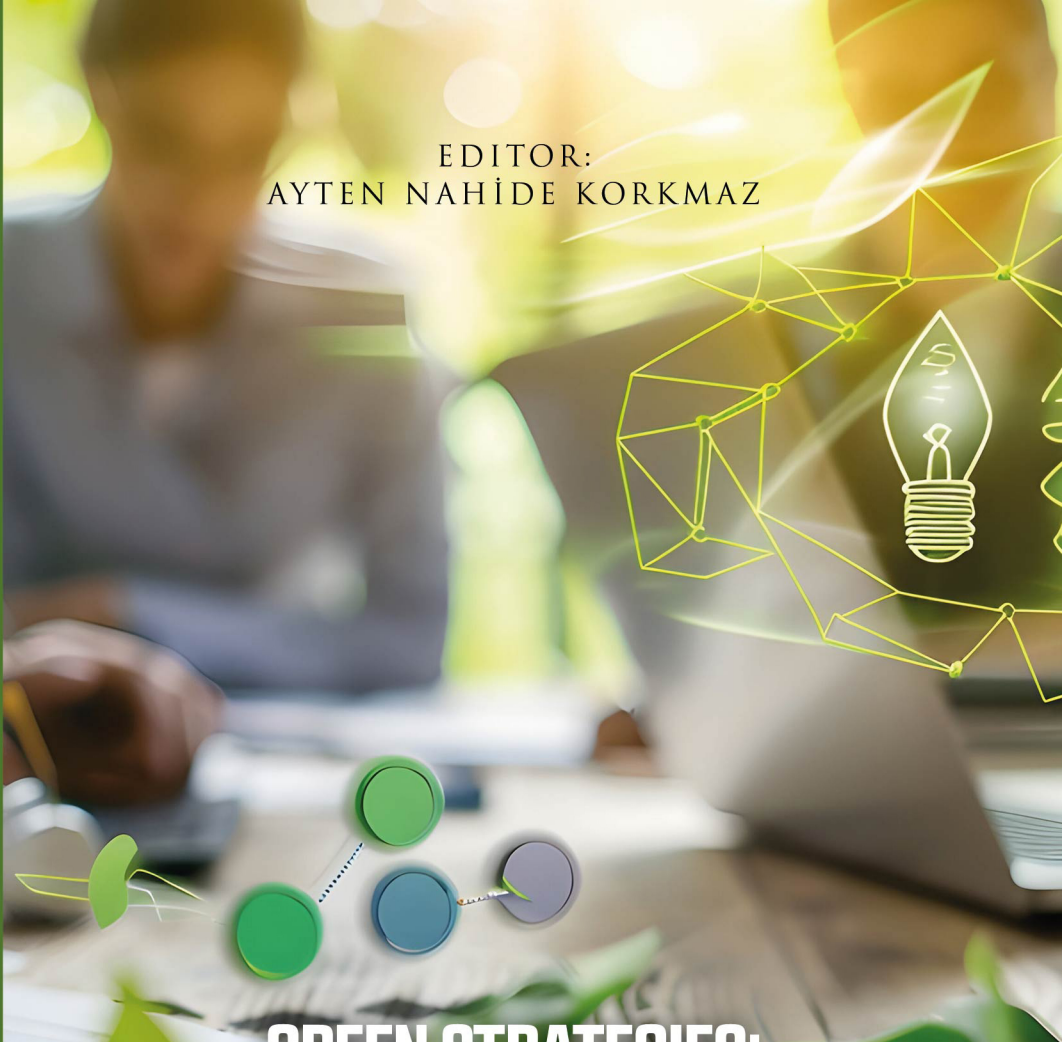

GREEN STRATEGIES: TRANSFORMING INNOVATIVE CONCEPTS INTO SUSTAINABILITY

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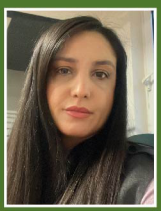

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Her research interests are: Microeconomics, Welfare Economics, Environmental Economics, and Bioeconomics.

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To my angel,Bilge…

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Mesut ÖZTIRAK

Preface

With great pleasure I present, *Green Strategies: Transforming Innovative Concepts into Sustainability* aims to represent new ideas about the hot topic "sustainability". As more and more people choose to live on Earth, sustainability is a goal. This term's definitions are debatable and have changed over time, across literature, and in different contexts. The three pillars of sustainability are typically social, economic, and environmental. This book aims to improve the sustainable world by offering fresh viewpoints based on a green attitude to serve as a useful manual for researchers.

First chapter it was tried to present the studies carried out by mentioning the importance of green and sustainable products in this context by mentioning the electric vehicles and charging stations used in the world and in Türkiye, which are included in the Sustainable and Intelligent Transportation Strategy announced within the scope of the European Green Deal. It is believed that the study, which is believed to be a guide for researchers, will fill the gap in this field. According to the second chapter, the studies conducted in Türkiye, it has been found that farmers use credit without considering the economics of credit use and financial principles, while credit institutions prioritize collateral and maturity practices that will guarantee the credit they provide. In the findings, it is observed that public and private banks do not have a sustainable agricultural credit policy, and the cyclical fluctuations of the economy are effective in this regard. According to third one, to achieve sustainable production and management of resources, it is imperative to develop new, safe, low-cost, eco-efficient and knowledge-based products. These products must support competitiveness and sustainability, while concurrently contributing to the economy through biotechnology. This approach aims to enhance health, increase agricultural and forestry yield and quality, and achieve sustainable improvements in environmental issues. In this context, the objective is to formulate policies for the implementation of innovative, high value-added, production-oriented bioeconomic approaches by protecting natural resources and ensuring their

rational use in ensuring the sustainable development of countries. According to chapter four, the literature and emphasizes how green marketing strategies are implemented to ensure long-term consumer trust from global brands to small businesses were examined. In addition, based on the findings obtained from the literature review, it is understood that green marketing strategies not only increase the brand reputation of companies but also make a great contribution to environmental goals, such as reducing carbon emissions and preventing waste. In the fifth chapter, where the theoretical framework is examined in detail, it is concluded that a greener and more sustainable workflow can be achieved in the aviation sector with the holistic processing of technology, policy, and efficiency measures. Another prediction obtained from the research is the contribution of market-based measures and subsidies to the sustainable aviation transformation in the same way to reduce carbon emissions with global regulations. In the sixth chapter, agricultural wastes and/or by-products used in the production of building materials are analysed. The results of the studies on the evaluation of these items are promising. Agricultural wastes and by-products can be used as reinforcement material in conventional concrete and mortars, in the production of insulation materials, in the production of lightweight concrete and soil-based composites. The seventh chapter provides businesses with a comprehensive approach to guide them towards a sustainable and agile future, offering strategic recommendations on how challenges encountered in this process can be turned into opportunities. Such a transformation aims not only for environmental and economic success but also for societal contributions.

This book aspires, new ideas nexus green approaches about sustainability in many areas. The valuable authors dedicated to impact the literature to fill the gap of green ideas and transform innovative approaches.

Sincerely,

Ayten Nahide KORKMAZ

10.03.2024

Florya/İstanbul

Ayten Nahide KORKMAZ, who graduated from Samsun Anatolian High School, learned English and German during her education and graduated with a Certificate of Honor. While studying at Dokuz Eylül University, Department of Economics, she had the chance to go to Germany to study languages through the Izmir German Cultural Center (Goethe Institute). She has articles published in international and national journals and papers presented in congresses. Ayten Nahide KORKMAZ is currently pursuing her PhD in the Department of Economics at Yıldız Technical University and is also graduated from second master's degree in "Economics" and "Bioeconomics". She is currently working as a lecturer and international academic coordinator at Istanbul Aydın University, Department of Foreign Trade, Foreign Trade Program (English).

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CHAPTER 1

ELECTRIC CHARGING VEHICLES UNDER THE EUROPEAN GREEN DEAL: THE CASE OF TÜRKİYE

Gizem ZENCİR[1]

Ayten Nahide KORKMAZ[2]

Abstract

The "EU Sustainable and Smart Mobility Strategy" was published on December 9, 2020 in order to support sustainable, smart and environmentally friendly transportation policy in line with the objectives of the European Green Deal. In this context, electric vehicles are considered to have a structure that has a smart ecosystem and can be connected and integrated into the created ecosystem, and it is estimated that sea and railways should be encouraged instead of mass road transportation where fuel consumption from fossil energy sources and thus emission production is high. It is predicted that electric vehicles will reach an important point in our country in a very short period of time, as it is the case all over the world (IEA, 2021), and that the number of electric vehicles in Türkiye will reach 2.5 million by the end of 2030 (Saygın et al., 2021). Electric vehicle sales figures and projections for the number of electric vehicle sales in the future are expected to be

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accompanied by an increase in the installation of electric vehicle charging stations, which are necessary for the functionality of electric vehicles. In this study, it was tried to present the studies carried out by mentioning the importance of green and sustainable products in this context by mentioning the electric vehicles and charging stations used in the world and in Türkiye, which are included in the Sustainable and Intelligent Transportation Strategy announced within the scope of the European Green Deal. It is believed that the study, which is believed to be a guide for researchers, will fill the gap in this field.

Key Words:the European Green Deal, Electric Charging Vehicles, Türkiye.

Introduction

The "Rio Earth Summit" held in 1992 is an action plan that guides a new international cooperation and development policy on the environment. The United Nations Framework Convention on Climate Change emerged as the first international environmental agreement and was approved by the parties and put into practice in 1994 (United Nations, 1992). With the Kyoto Protocol (2005), the parties set out more concrete targets, committing themselves to reducing greenhouse gas emissions, taking measures regarding climate change and reporting periodically on the subject in line with the targets agreed upon by the United Nations Framework Convention on Climate Change (United Nations, 1997). The contract consists of two commitments and expired in 2020. (United Nations, n.d.).

The 21st Conference of the Parties (COP21) held in Paris in 2015 was an important turning point in the fight against climate change. At this conference, the terms of the Paris Agreement were negotiated and it was decided that the agreement would enter into force after being accepted by 55 countries that, when brought together, are the source of at least 55 percent of greenhouse gas emissions (United Nations, 2015). With the achievement of this target in April 2016, the Paris Agreement entered into force. The Paris Agreement is the first universal and legally binding agreement that aims to limit the increase in global average surface temperature to 2 degrees, and if possible keep it below 1.5 degrees, in order to prevent the climate crisis.

As one of the countries that signed the Paris agreement, Türkiye has started some studies on net zero carbon emissions. In this regard, it has been concluded that the electric car market will grow rapidly throughout the automotive industry and in Türkiye, and the demand for autonomous driving and high safety technologies will also increase. The electric vehicle usage

rate increased by approximately 90%, from 772 to 1,884 between 2015 and 2018, and within the scope of the Zero Emission Public Transportation Project, which was carried out for the first time in Türkiye, the use of electric buses was initiated and it is aimed to purchase 380 more electric buses by 2024 (Bilgen Kocatürk et al., 2023,139-140) . Within the scope of public transportation, it is seen that the number of electric buses in 2019 was 119. This situation shows that the aim of environmental sustainability in Türkiye is becoming increasingly important for both public and private sector enterprises (Topal, 2019, 156).

Green Deal

The European Green Deal can be briefly defined as the new transformational economic change plan built by the European Union (EU) in order to combat environmental problems such as climate change, reducing gas emissions, etc. The 27 EU member states aim to achieve the goal of making the EU and even the entire European continent climate neutral (zero emissions) by 2050.

In line with this target, a promise has been made to reduce emissions by at least 55% compared to 1990 levels by 2030. In addition to the fact that its largest export market is the EU market, Türkiye strives to comply with the new EU regulations, regulations and acquis (Diriöz, 2021, 111).

Green Deal in Türkiye

When we look at the studies and practices on the subject in Türkiye, we see that Türkiye joined the United Nations Framework Convention on Climate Change in 2004; It appears that it became a party to the Kyoto Protocol in 2009 (T.R. Ministry of Environment, Urbanization and Climate Change, 2021b). Türkiye officially approved the Paris Agreement on October 6, 2021, and the year 2053 was declared as the year of net zero carbon emissions for Türkiye. With the decision published in the Official Gazette on October 29, 2021, the name of the Ministry of Environment and Urbanization was changed to the Ministry of Environment, Urbanization and Climate Change, and the Presidency of Climate Change was established (T.R. Official Gazette, 2021a). With the ratification of the Paris Agreement, the climate change agenda and green transformation process have gained importance in Türkiye. On September 30, 2015, the Intended National Contribution Declaration, which included activities and regulations to fulfill the main objectives of the agreement, was submitted to the Agreement Secretariat (T.R. Ministry of Environment, Urbanization and Climate, 2021). In this statement, Türkiye promised a 21 percent reduction in greenhouse gas emissions from the

reference scenario by 2030, that is, a reduction from an increase. The European continent is both the world's second largest economy and Türkiye's largest export partner. Therefore, it is not possible for Türkiye to remain outside this change and the Green Deal agenda. For this reason, the ratification of the Paris Climate Agreement is important in terms of determining the targets more clearly and taking action accordingly. Within the framework of the 2053 net zero carbon emission year target, energy, transportation, manufacturing, construction, etc. A serious transformation process needs to be undertaken in the sectors. However, efforts in this direction in Türkiye seem quite limited compared to the rest of the world. Green Deal Action plan, T.R. Published by the Ministry of Commerce on July 17, 2021. In the said action plan, 32 targets and 81 actions were set out under 9 main headings. Türkiye, which fell behind this plan as of December 2021, pledged to "reduce the increase by 21 percent" in the National Contribution Declaration submitted while signing the Paris Climate Agreement. However, there is already the capacity to achieve the targets specified in the National Contribution Declaration. For this reason, it is important to set more ambitious goals, create road maps in line with these goals and determine financing sources.

For these policies, it is important that the government creates a data-based road map as a first step. As a result of the implementation of policies towards climate change, in addition to reducing the negative effects of climate change, it is also possible to experience a 7 percent increase in national income (Seher & Durgun, 2019). Türkiye needs to speed up its work in this direction. The first step of the work is to evaluate the situation. Examining academic studies may be useful in this context.

The European continent is both the world's second largest economy and Türkiye's largest export partner. Therefore, it is not possible for Türkiye to remain outside this change and the Green Deal agenda. For this reason, the ratification of the Paris Climate Agreement is important in terms of determining the targets more clearly and taking action accordingly. Within the framework of the 2053 net zero carbon emission year target, energy, transportation, manufacturing, construction, etc. A serious transformation process needs to be undertaken in the sectors. However, efforts in this direction in Türkiye seem quite limited compared to the rest of the world. Green Deal Action plan, T.R. Published by the Ministry of Commerce on July 17, 2021. In the said action plan, 32 targets and 81 actions were set out under 9 main headings. Türkiye, which fell behind this plan as of December 2021, pledged to "reduce the increase by 21 percent" in the National Contribution Declaration submitted while signing the Paris Climate Agreement. However, there is already the capacity to achieve the targets specified in the National

Contribution Declaration. For this reason, it is important to set more ambitious goals, create road maps in line with these goals and determine financing sources.

Sustainable Green Products and Green Deal

With the increase in environmental awareness, the demand for environmentally friendly products has increased. Consumers prefer products that are recyclable, use renewable resources in production and do not harm the nature (Karaca, 2013). These trends have supported the formation of the green product concept. Green products are defined as products that do not harm nature, do not consume natural resources and are easy to recycle (Turhan et al. 2015). Green product is considered as one of the most important elements that contribute to development and growth. Green products are goods and services purchased by conscious consumers for environmental sustainability and better living standards. In other words, a green product is defined as an environmentally friendly product (Chen and Chai, 2010).

When green products are discontinued, they can be recycled by reusing harmless materials through separation. Environmentally friendly product; It refers to products that can save resources and energy through businesses during production and do not harm nature and human health (Varinli, 2012).

It is seen that the concept of green production has entered business life with the idea of creating less amount of waste after production (Yücel & Ekmekciler, 2008). As consumers prefer products that are less harmful to the environment, a new competitive environment has emerged for many industrial sectors. Regarding green production, the automotive industry is also taking important steps in the production of electric vehicles and it needs to be expanded. Although the electric vehicle market in Türkiye is still small, significant proportional increases in annual sales are observed, especially when hybrid vehicles are considered; It is predicted that the market may show a rapid growth trend with the TOGG brand electric vehicles that Türkiye's Automobile Enterprise Group will introduce to the market (Kocagöz et al., 2020).

Electric Vehicles in Türkiye

By taking a radical and important step in the field of electric vehicles in Türkiye, TOGG (Türkiye's Automobile Enterprise Group) was established to implement the natural electric vehicle production project. TOGG aims to produce sporty cars in the naturally electric C segment in 2022 and aims to

take them off the production line at the end of 2022. The electric vehicle to be developed and produced will have a structure that has a smart ecosystem and can be connected and integrated with the created ecosystem (TOGG, 2021). In order for electric vehicles to fulfill their functions, they must complement each other with a charging infrastructure. In this regard, electric vehicles and charging stations are an ecosystem that complements each other, one cannot function without the other (Köksal et al., 2021). It is predicted that electric vehicles will reach an important point in our country in a very short time, as in the whole world (IEA, 2021), and the number of electric vehicles in Türkiye will increase to 2.5 million by the end of 2030 (Saygın et al., 2021).

The automotive industry has always had a significant share in Türkiye's exports, imports and production. While the total automobile sales in Türkiye in 2023 was 2,290,280 units, the largest share among these was gasoline vehicles with 945,768 units and diesel vehicles with 625,501 units. According to Turkish Statistical Institute (TURKSTAT) data, the number of electric cars registered in traffic has increased compared to previous years. According to the institution's data, while traffic registrations were made for 3,192 electric cars in the first 11 months of 2021, this figure increased to 7,011 in the same period of 2022. (TURKSTAT, 2024, p. 49432) In January 2024, 53.1 percent of the vehicles registered in traffic are automobiles, 28.2 percent are motorcycles, 12.6 percent are pickup trucks, 2.4 percent are trucks. 2.1 percent were tractors, 1.0 percent minibuses, 0.4 percent buses and 0.2 percent special purpose vehicles. (TURKSTAT, 2024, p. 53453)

Charging Stations

As electric vehicles begin to take their place on highways, infrastructure investments established to meet the charging needs of these vehicles are increasing significantly. The charging infrastructure to be created will reduce the concerns of automobile consumers about running out of battery and being stranded on the road, and will enable them to turn to this technology, and electric vehicles will become widespread rapidly. The charging system infrastructure, which is a major factor in the spread of electric vehicle technology, should be a system in which each component is compatible with each other, safe and controlled. In order to fulfill these requirements, starting from the charging unit of the system, the electrical network and communication network will be discussed.

The charging station system is a structure that starts with the electrical energy infrastructure and installation, and ends with the units that perform energy flow and control to the vehicles and their communication

infrastructure. Within this structure, the energy infrastructure includes low voltage installations capable of meeting the charging capacity. This installation includes cable or busbar systems that feed the electrical panel and charging units. In addition, compensation and harmonic filtering units are also available in this installation in order to fulfill the energy quality elements. (Birizer, A., Şalci, M. S., Dikkulak, A., Güler, F., Turhan, E., Tic, G. E., & AŞ, S., 2015)

Charging Stations in Türkiye

Electric Vehicles are expected to have a significant share in the automobile market in the coming years due to the decrease in oil reserves and efforts to protect the environment. The fact that the energy required by these vehicles will be met from the grid will cause a large increase in load on the distribution system. This situation will strain the capacities of all electrical energy system elements, reduce their lifespan, and cause energy quality problems. The first method that comes to mind to prevent the mentioned problems is to increase the capacities of the components of the existing electrical system.

While electric car ownership increases every year, investment in charging stations also increases in parallel with this increase. According to the results of the study conducted by the Electric and Hybrid Vehicles Association (TEHAD), 11 companies in our country actually have charging station investments.

A Literature Review of Electric Charging Vehicles and Charging Stations

The articles were selected from Google Scholar database to examine the theoretical framework about EV and EVCS. When we searched the articles with the topic Electric Charging Vehicles and Charging Stations ", 18 related articles seen on Google Scholar.

Table 1. Studies on Electric Charging Vehicles and Charging Stations

Author(s)	***Journal/Book Name***	***Country***	***Year***
Dhameja, S.	Elsevier	USA	2001
Chan, C. C., & Chau, K. T.	Oxford University Press	USA	2001
Situ, L.	In 2009 3rd International Conference on Power Electronics Systems and Applications (PESA)	China	2009
Tran, M et all.	Nature Climate Change	UK	2012
Larminie, J., & Lowry, J.	John Wiley & Sons.	USA	2012
Erhan, K., Ayaz, M., & Özdemir, E.	Akıllı Şebekeler ve Türkiye Elektrik Şebekesinin Geleceği Sempozyumu	Türkiye	2013
Kerem, A	Mehmet Akif Ersoy Üniversitesi Fen Bilimleri Enstitüsü Dergisi	Türkiye	2014
Fincan, B.	Doctoral dissertation, Fen Bilimleri Enstitüsü	Türkiye	2015
Gürbüz, Y., & Kulaksız, A. A.	Gümüşhane University Journal of Science and Technology Institute	Türkiye	2016
Lin, J., Zhou, W., & Wolfson, O.	Transportation Research Procedia	USA	2016
Ding, N., Prasad, K., & Lie, T. T.	International Journal of Electric and Hybrid Vehicles	New Zealand	2017
İşen, E., & Tarlak, H.	Kırklareli University Journal of Engineering and Science	Türkiye	2018
Öztürk, Z	El-Cezerî Journal of Science and Engineering	Türkiye	2018
Kocabey, S.	Journal of Intelligent Transportation Systems and Applications	Türkiye	2018
Özbay, H et all	Journal of Intelligent Transportation Systems and Applications	Türkiye	2020
Kocagöz, E., & İğde, Ç. S.	Journal of Social Sciences of Kahramanmaraş Sütçü İmam University	Türkiye	2022
Karmaker, A. K et all.	Renewable and Sustainable Energy Reviews	Bangladesh, Australia	2024
Pasha, J et all.	Journal of Industrial Information Integration	USA, Canada, Hong Kong, Japan	2024

Discussion

If we look at the "breaking new ground: wind energy and the electrification of Europe's energy system" scenario from the EU's 2050 climate neutral continent targets according to the future energy scenarios of international organizations, we can see that an environmentalist perspective is in operation to determine the effects of current policies to achieve the Paris Climate Agreement's 2°C temperature increase limit and 90% CO2 emission reduction by 2050. In this context, Europe can come closer if it continues to implement policies in line with the Paris Climate Agreement with the action areas it has planned in line with the Green Deal. However, if we examine from the mentioned scenario, it emerges that the pace of transition to a green economy and energy transition in Europe is insufficient. It is estimated that the European Union needs to realize new additional policies and commitments in order to reach its 2050 targets (Yılmaz, F., 2022).

The first item on the list of long term plans is to look at the population growth of the countries and to estimate the most urgent need to start with the provinces of high population countries. The first conclusion to be drawn from the highly populated provinces is to investigate the most environmentally friendly and sustainable ways of using public transportation to get people from one place to another. The second conclusion is that the use of electric vehicles in public transportation should be initiated. If we look at the results of these conclusions; we come across the realization of charging stations in order to make this use widespread. In Istanbul, one of the highest cities of our country, public institutions continue this project with their own means, but insufficient funding sources are thought to prevent this situation from becoming Türkiye-wide.

Conclusions

The "EU Sustainable and Smart Mobility Strategy" was published on December 9, 2020 in order to support sustainable, smart and environmentally friendly transportation policy in line with the objectives of the European Green Deal. In this context, electric vehicles are considered to have a structure that has a smart ecosystem and can be connected and integrated into the created ecosystem, and it is estimated that sea and railways should be encouraged instead of mass road transportation where fuel consumption from fossil energy sources and thus emission production is high. It is predicted that electric vehicles will reach an important point in our country in a very short period of time, as it is the case all over the world (IEA, 2021), and that the number of electric vehicles in Türkiye will reach 2.5 million by the end

of 2030 (Saygın et al., 2021). Electric vehicle sales figures and projections for the number of electric vehicle sales in the future are expected to be accompanied by an increase in the installation of electric vehicle charging stations, which are necessary for the functionality of electric vehicles.

Charging infrastructure is essential for the operation of electric vehicles. Charging station systems consist of a complete system with electrical energy infrastructure, installation, units and their communication infrastructure (Birleştirici et al., 2015). In order for a vehicle not to experience charging station problems in a different country, it is thought that they should act in line with international projects and company partnerships. It is estimated that one of the objectives of the European Green Deal is to provide support on a country basis in the partnership of companies and the distribution of funds in order to find common solutions.

Abbreviations:

EU: European Union

EVCS: Electric vehicle charging station

TOGG: Türkiye's Automobile Joint Venture Group

TURKSTAT: Turkish Statistical Institute

TEHAD: Electric and Hybrid Vehicles Association

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CHAPTER 2

THE CAPITAL STRUCTURE AND CREDIT USE APPROACHES OF FARMS IN TÜRKIYE[1]

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Abstract

Based on the results of studies on this topic, this study examines the capital structure and credit use of agricultural enterprises in Turkiye and the attitudes of producers towards the use of credit. In the study, research and studies on the subject were used. According to the results of the analysis, it was found that the capital structure and financial resources have shown significant changes in different time periods, regions and types of farms in Türkiye. Although the number of producers using agricultural loans has increased in Türkiye in the 2000s, the share of these loans in the total capital of the farms is low compared to developed countries. In the studies conducted in Türkiye, it has been found that farmers use credit without considering

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the economics of credit use and financial principles, while credit institutions prioritize collateral and maturity practices that will guarantee the credit they provide. In the findings, it is observed that public and private banks do not have a sustainable agricultural credit policy, and the cyclical fluctuations of the economy are effective in this regard.

Key Words: Capital Structure, Credit Usage, Farms, Türkiye.

1. Introduction

Changes are taking place in all sectors of the world due to natural, economic, social and technological developments. These developments have led to important developments and changes in the agricultural sector in developing and underdeveloped countries, including developed countries. In Türkiye, which belongs to the category of developing countries, the rural population is decreasing in absolute terms. However, the rural population still constitutes a significant proportion of the total population in underdeveloped and developing countries (Yılmaz, 2015). In Türkiye, intensive rural-urban migration and rapid urbanization began after 1950 (Tümertekin, 1973). However, unlike Western Europe, rural-urban migration and the resulting rapid urbanization in Türkiye were not only the result of industrialization. Many factors such as mechanization in agriculture, continuous division of agricultural land through inheritance, job, education and health opportunities in cities are among the main reasons for migration to cities (Yılmaz, 2015). However, the flow of migration from rural to urban areas in Türkiye has not reduced the expected population pressure on agricultural lands to the desired level. In fact, an analysis of the average farm size from the 1950s to the 2000s shows that it has changed in the range of 5-7 ha (TurkStat, 2001).

In developed countries, technical studies of agricultural production, especially field and horticultural agriculture, initiated in the 1880s to meet the growing food needs of urban populations migrating from rural to urban areas, could not by themselves make farmers successful. As a business, the farm had to be managed successfully technically, economically and socially. In this context, in the early 1900s, agronomists in the United States also began to study the costs and revenues of farms. With these studies, factors affecting the success of operators and many performance standards used to determine the most profitable size and type of farms were established. In this context, the source of the developments in agricultural management in the world has been the continuous and qualified research carried out in universities, research institutes and agricultural professional organizations (İnan, 2006).

Countries' ministries of agriculture are constantly developing alternative policies to meet the food needs of their populations. In addition, countries also seek to benefit from grants and support programs provided by other relevant international institutions and organizations for the development of the agricultural sector. For example, in Türkiye, the Agriculture and Rural Development Support Institution and Development Agencies (within the framework of IPARD programs), which were established with the support of the EU, provide grants and support to agricultural enterprises in various fields. These grants and support have enabled agricultural enterprises and many large capital companies to make new investments. In addition, in some regions, producers have established large orchards and vineyards, creating large commercial agricultural enterprises using new technologies. These developments have necessitated changes in the organizational structures of agricultural enterprises and thus in the management of business functions.

In addition to the traditional business management approach, the large commercial agricultural enterprises in Türkiye and other countries that have been established with various support must, on the one hand, establish a profitable capital structure and, on the other hand, establish a production plan that ensures factor utilization and profit optimization in accordance with the principles and rules required by the production economy. On the other hand, if the management, production, marketing, accounting and finance, human resources, research and development, and public relations functions of agricultural enterprises are carried out according to scientific principles, the profitability and sustainability of the enterprises will be ensured. In addition, it is not possible for an enterprise to be successful without considering the basic principles of financial management (Aydın et al., 2014).

In agricultural enterprises, the creation of a rational business capital structure and a successful business organization is based on the knowledge, experience and expertise of the operator. In Türkiye, decision-making activities in the agricultural sector, especially in agricultural enterprises, are generally not carried out with scientific methods based on knowledge. For farmers to create a profitable capital structure and determine their real credit needs, it is necessary to know the business structure and operating results well. In this context, there is a growing need for research to raise awareness in the sector and to meet the information needs of agricultural enterprises and decision-making institutions and organizations. This research contributes significantly to the decision-making of stakeholders. In fact, in this context, research on the economic structures of agricultural enterprises in the USA in the early 1900s has been used for many years as basic data to explain

the characteristics of agricultural enterprises in the respective regions (İnan, 2006).

In this study, the capital structure and credit utilization status of agricultural enterprises in Türkiye, which is one of the factors affecting the activities and costs of agricultural enterprises, were evaluated by analyzing the relevant literature.

2. The Capital Structure and The Approaches to Credit Use of Farms in Türkiye

Studies on capital structure and credit use in the agricultural sector generally analyse the issue at micro and macro levels. At the micro level, the studies on capital structure in agricultural enterprises consist of studies on the level of credit utilization, preferred institutions and organizations in credit utilization, problems in credit utilization and determination of credit needs in enterprises. At the macro level, there are studies on the credit practices of institutions and organizations that provide funds to the agricultural sector in Türkiye and the importance and contribution of credit utilization in general in terms of the agricultural sector and rural development.

2.1. Capital Structure in Farms; Conceptual and Theoretical Approach

One of the factors that affect the performance of agricultural enterprises is the amount and structure of capital owned by the farms. The concept of capital structure was first defined by Modigliani and Miller as the combination of debt and equity capital used by the firm in its operations. Over time, the relationship between capital structure and the profitability and value of the firm has been an important topic of discussion (Abor, 2005). Like the harmony and balance that should exist in every event and phenomenon, the main objective in the financial management of a business is to create an effective capital structure for business success. One of the key financial decisions for better business development is the level of the ratio of equity and foreign resources in the capital of the company and the allocation of these resources to capital elements (Aulova and Hlavsa, 2013).

Establishing the capital structure of a farm is a challenging process that is influenced by several factors. Determining the factors to be considered when forming the capital structure is primarily important for optimizing the capital structure and thus for the future development of the farms. The factors that are effective in determining the capital structure in farms can be classified

as internal and external factors (Prášilová, 2012, as cited in Aulova and Hlavsa, 2013). External factors are economic policies (e.g. monetary policy and interest rates, level of taxation, etc.), social environment, government intervention, capital market situation, information asymmetry and others that the enterprise cannot influence. Internal factors are those that the company can influence to a certain extent, primarily the type of company and its economic efficiency. This group also includes some indicators of the company's efficiency, such as the company's asset structure, asset profitability, liquidity, profit stability and cash flow, or the uniqueness of the product. On the other hand, the growth opportunities of the enterprise, the relevance of the industry and the age of the enterprise are also influential (Prasilova, 2012, as cited in Aulova and Hlavsa, 2013).

The decision to use equity or foreign capital in a firm is related to the cost of that capital. In the case of using foreign capital, this capital is mainly represented by interest costs, while equity capital is evaluated based on opportunity costs. In financial theory, the ratios of the level of equity and the use of foreign capital are considered conditional theories of the capital structure of enterprises. Approaches to what these ratios should be can basically be divided into two main groups (Aulova and Hlavsa, 2013). The first approach is static capital theory, which is based on economic theory and builds a capital proposal or recommendation model for enterprises based on information derived from economic theory. Based on economic theory, the proposed capital structure is theoretically validated. In this approach, the individual capital structures of companies are different, but in terms of the relationship between market capitalization and the chosen capital structure, it is recommended that there should be a balanced situation between the objective of the company and its capital structure. At the same time, it is emphasized that enterprises should strive to achieve this and ensure it through financial decisions (Kislingerova et all., 2007, as cited in Aulova and Hlavsa, 2013). The second group consists of dynamic capital structure theories based on a completely different principle. When building proposals or capital structure models, the focus is on information about the current capital structure of firms and on this basis theoretically generalized concepts are created (Kalouda, 2009, as cited in Aulova and Hlavsa, 2013). This theory is based on the belief that there is no optimal capital structure for firms in general and that attempts to generalize about capital structure optimization and its impact on a firm's market value can be misleading. It assumes that each company continually optimizes its financial decisions in response to changing specific circumstances.

A review of the literature on capital reveals that the debate generally centers on whether a firm's capital structure or its use of debt maximizes the value of the firm. According to Weston and Brigham (1992), the optimal capital structure is the capital structure that maximizes a firm's market value. In the theoretical work of researchers on what is the optimal capital structure, which is the combination of capital that maximizes the value of the firm, that is, the capital structure that minimizes the cost of capital and provides a return between risk and return, no definition has yet been found to be recommended to financial managers (Gitman et all, 2015). The assessment of the capital structure and the factors affecting it is the goal of much authors' research, and therefore there is a large body of literature and articles focused on this area. This type of research, especially in the United States, is mainly focused on industrial enterprises, especially small and medium-sized enterprises. In the European region, such research is often based on the US and is being expanded and supported in various ways. Recently, such research has increasingly focused not only on the practical application of individual contingent theories but has attracted both theoretical and empirical studies. In this context, it should be emphasized that studies on the capital structure of agribusinesses and the determinants of capital structure focus mainly on the debate on the definition of the term capital structure and the analysis of its determinants (Aulova and Hlavsa, 2013).

Many studies have been conducted on the relationship between capital structure decisions and firm performance. In the finance and accounting literature, economic and financial profitability criteria are used as the main criteria for measuring the performance of investment and equity capital (Chen, 2004). In particular, the financial profitability criterion is used to measure the profitability of equity capital, which is included in the liabilities on the balance sheet and which shareholders attach to the firm. While the profitability of all assets, i.e. working capital, is important in companies, the profitability of equity capital is more important. For this reason, return on equity is the best measure of the impact of capital structure on operating performance. However, the literature on how leverage or debt affects firm performance or its impact on operating performance has varied in approach and results examined the relationship between capital structure and profitability of listed firms in Ghana and found that there is a positive relationship between financial profitability and capital structure (Abor 2005, as cited in Eljelly, 2004). On the other hand, many other studies have found a negative relationship between financial profitability and capital structure (Barton, et all, 1989; Chittenden, et all, 1996; Jordan, et all, 1998; Oğuz

and Yener, 2018). Similar results have also been found in different countries (Zeitun and Tian, 2007).

There are other studies in the literature that show that differences in the capital structure of firms - and in this context, especially differences in the debt structure - have different consequences for the financial profitability ratios of firms. For example, long-term debt has relatively higher interest rates, especially in the U.S. financial market, and therefore high debt levels have led to lower profitability (Fama and French, 1998; Miller, 1977). Firms are said to meet their financing needs first from retained earnings, then from debt, and finally by raising new equity. This suggests that there is a negative relationship between profitability and the debt-equity ratio (Myers and Majluf, 1984). Studies across different sample countries and firms have also shown that long-term debt has a significant negative relationship with total assets and profitability (Al-Taani, 2013; Lorpev and Kwanum, 2012). This is consistent across firms ranging in size from large firms to SMEs in international markets (Cassar and Holmes, 2003; Rajan and Zingales, 1995). Fama and French (1998) also find that more debt leads to conflicts of interest between managers and owners (agency theory), and that there is a negative relationship between profitability and long-term debt-equity ratio. Studies of Indian firms have found that there is a one-to-one relationship between long-term debt and assets and profitability variables, and that capital structure has a significant impact on firm profitability (Ramachandran and Candasamy, 2011).

2.2. Capital Structure of Farms in Türkiye

The capital structure of agricultural enterprises is one of the issues studied in the economic analysis of agricultural enterprises in almost all regions in Türkiye. In the study of capital structure in agricultural enterprises, the issues that are focused on are analyzed by determining the combination of active capital - current assets, medium-term assets and fixed assets when the classification according to liquidity is taken into consideration, and the distribution ratios of operating capital and working capital when the classification according to their functions is taken into consideration. On the other hand, it is also related to the sources of existing assets in companies, i.e. the forms of financing.

Studies carried out in Türkiye on the source of capital in agricultural enterprises, i.e. the passive capital situation, show that the equity ratio is over 80-90%, although it varies according to the year and region (Karacan, 1991). In addition, a study conducted in the Central Anatolian Basin in 2020

found that the equity ratio ranged from 52.55% to 87.46%, depending on the type of enterprise. This ratio is 84.01% in specialized crop farms, 94.70% in specialized vegetable farms, 96.33% in specialized animal farms, 52.55% in mixed crop farms and 87.46% in mixed crop and animal farms. In the mixed cropping enterprise type, it was found that the equity capital ratio was low due to the high level of 45.17% of land capital held for rent (Çelik et al., 2020). Therefore, these results show that agricultural enterprises in Türkiye operate largely based on equity capital. The high rate of equity capital in agricultural holdings in Türkiye is because agricultural holdings produce on land based on ownership and land values are high especially in some regions, the size of the holdings is small and accordingly the level of technology utilization is low, i.e. capital-intensive production is not carried out.

In Türkiye, the ratio of credit utilization to total active capital is generally between 1% and 5%, especially in crop-oriented enterprises (Artukoğlu, 1993). In this context, it was found to be 2.3% in the average of agricultural enterprises in the central district of Manisa (Artukoğlu, 1993), 5% in the Turhal district of Tokat (Adıgüzel, 2006), 2.32% in irrigated agricultural enterprises and 3. 45% in dryland farms in the Harran Plain of Sanliurfa Province before the transition to irrigated agriculture under GAP (Çelik, 2000), 1.08% in a study conducted in Samsun Province (Yulafcı, 2007), and 8.6% in carrot production farms in Konya Province (Çelik and Direk, 2008). In a study conducted in the Central Anatolian Basin, the proportion of short-, medium- and long-term loans used in passive capital was found to be between 1.24% and 4.37% (Çelik et al., 2020). In some provinces, this ratio is close to that of agricultural enterprises engaged in animal, vegetable and fruit production, and in some provinces, it is as high as 30%. It has also been observed that these ratios have changed in the historical process. In fact, while this ratio was between 5% and 30% in fattening cattle and sheep farms of different sizes in Erzurum and Erzincan provinces (Zoral, 1973), this ratio was calculated as 2.5% (Kan, 2005), 4.08% (Oğuz and Yener, 2017a), and 6.80% (Oğuz and Yener, 2017b) in dairy farms in Konya province. It was 15.39% in broiler farms in Bolu province (Beşparmak, 2002) and 7.8% in dairy farms in Hatay province (Semerci et al., 2015).

In addition to the resource structure of capital in agricultural enterprises, i.e. the situation of coverage by equity and foreign capital, the distribution of this capital according to the active capital elements, i.e. the use of this capital, also affects the activity and cost efficiency of enterprises. The combination or distribution of capital in agricultural enterprises will naturally differ according to the type and size of the enterprise. However, it is generally recommended in the relevant literature that in order for agricultural enterprises to operate

rationally, 25% of the active capital should be land capital, 25% building capital, 25% animal capital, 10% tool-machine capital, 10% material and ammunition capital, and 5% money capital in enterprises that carry out plant and animal production activities together (Erkuş et al., 1995). However, as mentioned in the previous section, it should be considered that the optimal capital component in enterprises will vary according to the region, type and size of the enterprise. In the studies conducted in Türkiye since the 1970s, it has been found that the most important part of capital in agricultural enterprises at the level of 50-80% consists of land capital (Bülbül, 2006). For example, land capital is 56-62% in agricultural enterprises that are members of agricultural credit cooperatives in Erzurum (Özçelebi, 1973), 77. 5% in Manisa central agricultural enterprises, 64% in Edirne, 78% in Tekirdağ, 54% in Kırklareli, 79% in Adana, 66% in İçel, 62% in Ankara, 60% in Konya, 72% in Samsun and 79% in Mardin-Şanlıurfa (Artukoğlu, 1993; Bülbül, 2006; Yulafcı, 2007). In a study conducted in 2020 in the Central Anatolian Basin, 2.07% of the active capital of the enterprises growing specialized field crops, 3.09% of the enterprises growing specialized vegetables, 7.91% of the enterprises growing specialized livestock, 2.07% of the enterprises growing mixed crops, and 6.22% of the enterprises growing mixed crops and animal products are composed of revolving capital. In the same types of enterprises, 7.75%, 8.06%, 34.05%, 3.20%, and 21.40% of the active capital consisted of medium-term assets and 89.57%, 88.85%, 58.04%, 94.73%, and 72.38% of fixed assets, respectively (Çelik et al., 2020).

Considering the combination of capital in agricultural enterprises in Türkiye, there is a need for credit due to the low level of working capital and at the same time, the level of credit utilization is also at a low level. It has been found that the low level of credit utilization despite the low level of working capital is not due to the lack of need for credit in Turkish agricultural enterprises, but to the fact that they cannot find credit in sufficient amounts and when they need it (Bülbül et al., 1990). In countries with advanced technology and intensive agriculture, the rate of borrowing is high. In fact, this rate is 52% in Switzerland, 43% in Denmark, 18% in the US and Canada, 22% in the Netherlands, 20% in Germany, 14% in the UK and 13% in France (Bülbül and Bektöre, 1981).

2.3. Credit Using Approaches in Agricultural Enterprises

In Türkiye, a significant number of direct and indirect studies have been conducted on the credit utilization approaches, reasons and preferences of

credit sources of agricultural enterprises. In these studies, it has been found that credit utilization approaches differ in different regions and different types of enterprises. In this context, in a study conducted in Torbalı district of İzmir province, the level of credit utilization in agricultural enterprises and the reasons for using or not using credit and the reasons for preferring credit sources were investigated. In the study, it was found that 71.3% of the producers used credit. Among the producers who use credit, 70.5% are enterprises that cultivate more than 50 decares of land. It was found that the producers preferred operating credit mainly for planting, maintenance and harvesting expenses, and investment credit for the purchase of tools-machinery and land (Özden et al., 2012). In a study conducted in Eskisehir province, the status of credit utilization and whether the loans received were paid or not was examined. According to the results of the research, it was determined that 58.27% of the enterprises used short-term loans and 41.73% used medium and long-term loans in the five-year period. 38.26% of these loans are subsidized loans. Among the subsidized loans, agricultural mechanization loans ranked first with 38.88%. It was found that 70.94% of the enterprises used credit cards structured for agriculture and 9.4% of the enterprises could not pay their debts on time (Ünlüer, 2004). In general, although the proportion of producers using short-, medium- and long-term loans in agricultural enterprises is up to 40-50% in some provinces, the proportion of loans used in the total asset capital is low.

It has been determined that the most important factors in the low use of credit by farmers are inadequate collateral, fear of not being able to repay the loan, inflexible collection approaches of private banks, lack of payment planning based on cash flow, high interest rates and commissions (Anonymous, 2012). However, in the study conducted in the priority provinces for development, 25% of the producers stated that they did not need credit at all, while 73% stated that they could use credit if it included favorable terms and conditions. Therefore, taking these rates into account, it can be concluded that there could be new potential credit users at the level of 45%. An important finding of this study is that only 22.6% of producers indicated that lack of finance was a challenge for their farms. This result also indicates that producers are not sufficiently aware of the need for optimal input use and its impact on business activities beyond traditional production approaches (Anonymous, 2012).

In a study conducted in the GAP region, it was found that debts to individuals accounted for 48% of total farm debts (Bülbül et al., 1986). It was also found that 32.73% of the loans used in the GAP region were for cash, 28.70% for fertilizer and 10.62% for seeds (Karlı and Yurdakul,

1992). In a study conducted in Çukurova region, it was found that 6.4% of small producers obtained credit from unorganized credit sources and paid 2.25 times higher interest rates than organized credit sources. In addition, it was found that producers could not find credit when they needed it (Yurdakul et al., 1991). In a study conducted in Adana and Içel provinces, which examined the use of credit in agricultural enterprises and the place of cooperatives in this system, it was found that 27% of the credit was provided by unorganized credit sources and that the inability of organized credit institutions to provide sufficient credit and the inability of enterprises to meet the necessary conditions were effective in this result. The study also emphasized the need to determine the maturity and interest rates of agricultural loans by considering the characteristics of agricultural activities in the respective region (Ozçelik and Turan 1989). In another study, 38.03% of the producers completed their capital deficiency only with unorganized credit sources, 35.21% only with institutionalized credit sources and 26.76% with both credit groups (Adıgüzel, 2006). In a study conducted in Denizli province, it was determined that 75% of the enterprises were in debt, 18% of their existing debts were to unorganized credit sources and 82% to organized credit sources (Aydoğan, 1991). In another study conducted in the province of Tokat, it was found that small enterprises used more credit in proportion but less in amount (Fırat, 1999). In Keskin district of Kırıkkale province, it was determined that 91.8% of the producers used credit, although it varied according to the villages (Gülçubuk, 2000). In a study conducted in dairy farms in Konya province, 59.78% of the debts of dairy farms were animal production credits, 12.75% were private consumption credits, 12.37% were tool-machinery credits, 11.04% were crop production credits, and 4% were loans, 06% of individual debts, 58.79% of the debts per enterprise were land debts, 37.86% were long-term debts and 3.35% were short-term debts (Oğuz and Yener, 2018). The results of various studies show that credit utilization varies significantly by time, province and region.

Gülçubuk (2000), in his study on the socio-economic effects of credit use in rural areas, found that 87.3% of the landowners in the TCZB study villages and 91.6% of the landowners in the TKK study villages used credit. In addition, it was found that the use of credit in the villages studied did not provide sufficient efficiency for production, in this respect the producers had the perception that they had receivables from the bank every year, and it was found that the use of credit became a habit rather than an economic approach, especially that the necessary cost/profit analyses were not made.

2.4. Factors Affecting the Repayment of Loans Used in Agricultural Enterprises

The fact that most farms in Türkiye are small and therefore cannot generate sufficient income leads to the need for credit for business activities. The factors influencing the use of credit in agricultural enterprises have been analyzed from different perspectives in different studies. In this context, in a study of agricultural enterprises in Adana Plain, it was found that there was a significant relationship between the size of the enterprise and the total amount of credit used, and that there was a significant relationship between short-term debt and total operating costs (Bülbül 1973). On the other hand, logistic regression analysis was conducted to determine the factors that may cause the default of loans used by producers in agricultural enterprises. As a result of the analysis, it was determined that the variables of economic profitability ratio, loan maturity and leverage ratio are determinants of loan affordability (Ünlüer, 2004). It was determined that the most important problem encountered in the use of bank loans is the problem of collateral, and factors such as fear of repayment, high interest and commission rates are also effective in repayment (Anonymous, 2012).

In some provinces of Türkiye, studies have been carried out to determine the credit demand or need of agricultural enterprises. Some of these studies are the studies in which credit needs are determined by considering the difference between working capital and changing costs at the average level of enterprises in general without considering the types of enterprises (Erkuş and Güneş; 2002; Güneş, 2004; Karlı 1991; Toy, 2003). On the other hand, credit needs have been determined at the level of products produced in agricultural enterprises based on changing costs (Altürk, 2007). However, not enough studies have been conducted to determine periodic credit needs at the level of enterprises based on different types of enterprises and cash flows. In this context, the periodic determination of cash flow and credit needs was carried out for different types of enterprises in 2020. According to the results of the study, it was determined that there is a need for credit for planting and maintenance operations in spring and summer, although there is a difference in periodic credit needs according to enterprise types. Since the cash flows of the enterprises vary according to the type of enterprise, it was found that their solvency also varies (Çelik et al, 2020). In the agricultural sector, on the one hand, the amount of land owned by the enterprise and the irrigated or dry land and, on the other hand, the differences in the type of enterprise, i.e., the combination of crops grown, also affects the income of agricultural enterprises and thus the ability to repay loans.

2.5. Evaluation of Agricultural Credit Practices of Credit Institutions in Türkiye

In the field of agricultural credit, agricultural credit institutions and organizations at the macro level and their agricultural credit policies, practices and effects on the agricultural sector have been studied. By examining the research conducted in this context and by examining the agricultural credit policies in Türkiye, it is found that the credit needs of the producers are not adequately met and that the producers apply to unorganized credit sources to a significant extent and that some of the loans are used for consumption. It is emphasized that credit can be used more effectively by developing mechanisms that improve the agricultural structure and increase income levels, improve income distribution and reduce income uncertainty (Bülbül and Bektöre, 1981).

In some studies, it was found that the loans received in agricultural enterprises were used for purposes other than production (Bülbül et al., 1990; Karlı, 1991). In this result, it was emphasized that in the 1990s, when these studies were conducted, agricultural organizations did not make decisions based on objective criteria in the allocation of loans to agricultural enterprises. For this reason, it was emphasized that the credits remained as consumption credits rather than increasing agricultural production. It has been emphasized that to achieve the agricultural development envisaged in the development plans, a detailed analysis of the agricultural structure and the collection of research and statistical information based on accurate data are necessary (Özçelebi, 1973; Ralph, 1961).

In addition to the general economic situation, the state's approach to agriculture, the structure and characteristics of agricultural production play a role in the financing of agriculture, unorganized credit resources have an important share in the sector, and it is also emphasized that it is important to increase credit opportunities for small enterprises by creating a system that leads cooperatives to financial independence (Ürper, 1990). In his study, Çevikbaş (1991) stated that foreign resources in providing capital to agriculture are limited due to the general structure of agricultural production and that it is important to increase the savings rate and develop capital accumulation through other support policies in the agricultural sector and in the development of the country. Bülbül and Tatlıdil (1994) in their study suggested the effective use of credit for structural improvement in agriculture, the establishment of an effective communication network between agricultural organizations and producers and the allocation of more resources to agriculture.

In another study, which examined the agricultural credit policy in Türkiye, it was suggested that the agricultural credit practice, which is an important tool in the management and realization of production, cannot be carried out properly throughout the country and that the institutions that make and carry out agricultural production planning and the institutions that will provide credit in accordance with this planning should work in harmony and cooperation (Demirperçin, 1981). Also in this context, the development of the sources of agricultural credit, especially in the period 1970-1980, was analyzed in the study that examined the issue of credit in development plans. In the study, it was suggested that the existing agricultural credit system should be improved, priority should be given to medium and small enterprises in lending, the low-interest credit policy should be revised, credit should be given mostly in the medium and long term, and agricultural inputs should be provided to farmers together within integrated credit activities (Akın, 1986).

The self-financing capacity of Turkish agriculture was limited, so that foreign financing predominated and the TCZB could not be effective in agricultural financing because of the many functions it performed (Cingi, 1989). On the other hand, in another study, it was emphasized that although TCZB contributed a lot to the development of the agricultural sector through loans, it was not enough to increase the total production, to satisfy the needs of the producers and to develop the cooperatives. In addition, the inadequacy of the amount of credit granted, the long time required for credit transactions, the high interest rates on loans, and the requirement of mortgages on real estate to open loans were identified as the main problems of the sector (Saral, 1989). It was emphasized that the maturity and interest rates of agricultural loans should be determined considering the characteristics of agricultural activities (Özçelik and Turan, 1989). Artukoğlu (1993), in his study, found that an effective and continuous credit policy was not followed in Türkiye and that credits did not create sufficient development in terms of investment and agricultural development. In the light of the information obtained from the enterprises, it was found that the producers experienced high interest rates, short credit periods and problems in finding collateral.

Research on the credit problems of the agricultural sector and the role of the agricultural credit associations to overcome these problems has shown that the agricultural credit associations are the only organizations that are able to provide credit to small producers, which constitute most of the agricultural credit system (Çiftçi, 1998). In a study on cooperative organizations conducted in Elazığ Central District, it was suggested that the problems related to agricultural credit can only be solved with the joint efforts of the state and the producers, and within this framework, the state should undertake

the task of cooperative education, organize cooperative financing, provide a suitable and reliable credit mechanism to the agricultural sector in terms of payment and interest, and the producers should fully fulfill their cooperative partnership obligations (Karacan, 1975). In a study conducted in Tekirdağ province to determine the role of Agricultural Bank in financing agriculture in Türkiye, it was found that producers could not meet their credit needs in a timely and adequate manner due to various bureaucratic procedures and high interest rates. It was emphasized that despite the continuous increase in input prices, product prices did not increase at the same rate, which reduced the income of producers and that a cooperative bank should be established to solve the financing problems of producers and agricultural loans should be evaluated by agricultural economists who are experts in the field (Arıcı, 2007).

According to a study on the development of agricultural credit in Turkiye and its impact on the sector, the interest of private banks in agriculture has increased in recent years, and the amount of agricultural loans from private banks, which was limited to TL 10.5 million in 2001, reached TL 4.7 billion in 2008. It was also emphasized that the global crisis had a negative impact on agricultural enterprises and credit utilization, and that the problems of farmers in repaying the loans they used shrank the sector and jeopardized sustainable agricultural production (Güneş, 2009). In a similar study, it was found that the agricultural loan balances of Agricultural Bank increased, but the share of agricultural loans in the total loans disbursed gradually decreased, and in parallel, private banks focused on loan disbursement in the sector (Güneş and Artukoğlu, 2010). It is emphasized that due to the preference of private banks to provide mortgage-based loans, farmers have difficulties in obtaining and repaying loans, which resulted in the development of negative perceptions of farmers towards private banks (Anonymous, 2012).

3. Conclusıons and Recommendatıons

Technological, economic and social developments in countries have made agribusiness activities more complex. For this reason, the importance of working with information-based decision-making models in business management and policy development for all economic sectors is increasing day by day. The management style based on advanced decision-making models in enterprises and sectors is directly related to the level of development of countries and sectors. In the current process, it is observed that these processes are accelerating in developing countries due to the importance of knowledge-based decision-making models in creating competitive

advantage. However, studies and practices in developing countries are not at a sufficient level and sectoral differences are also significant. In order to make information-based decisions in agricultural enterprises, information systems need to be established. One of the most important information systems is farm accounting. However, in the world, and especially in developing countries, farm records are not adequately kept in agricultural enterprises for various reasons. Therefore, in agricultural enterprises where records are not kept, financial decisions and business organization are based on the intuition and experience of the business manager.

As in other fields, there is a great development and change in the field of financial management in the world. In fact, the speed of change and development in the field of financial management is higher than in other fields due to its characteristics. For this reason, it has increased the importance of financial management in the creation of both fixed and revolving capital combinations and the use of credit in all large and small agricultural enterprises. In today's market conditions, where uncertainty and change are increasing rapidly, it has become very difficult to increase the efficiency of financial decisions. In these changing conditions, the effectiveness of financial decisions in businesses has become a key component of business success. As in other disciplines, the principles of production economics should be considered to increase the efficiency of financial decisions.

The capital structure of farms in Türkiye is influenced by a mix of traditional practices, government support, and modernization efforts. While significant progress has been made, challenges such as land fragmentation, access to finance, and climate risks remain critical areas for improvement. Improved financial instruments, better infrastructure, and targeted policies could further strengthen the capital base of the agricultural sector.

Since 84% of the agricultural holdings in Türkiye consist of farms with less than 100 decares of land, there is a need for working capital even if they do not have sufficient income. There are also successful credit practices in these small agricultural enterprises. For this reason, it is necessary to make decisions on the use of credit by examining the effect of borrowing on working capital in small or large farms. The profitability ratios, which determine the profitability of working capital and equity capital in different regions according to enterprises in general and land sizes, have been determined in almost all economic analysis studies. However, detailed analytical studies on credit utilization in agricultural enterprises and the effect of other socio-economic factors on financial profitability in different types of enterprises will enrich the subject.

According to the studies conducted, there is a need for research on the correct determination of the amount and timing of credit in different types of farms for the sustainable allocation and use of credit in the agricultural sector and the analytical study of the impact of the credit used on the results of business activities.

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CHAPTER 3

BIOECONOMY APPROACH TO SUSTAINABLE DEVELOPMENT

Zuhal KARAKAYACI[1]

Abstract

The increase in global population, climate change, pandemics, economic and social problems, wars, famines, droughts and environmental pollution have caused an increase in needs, rapid consumption of natural resources and serious environmental problems on a global scale. In particular, there has been a notable increase in natural disasters such as forest fires, hurricanes and floods in recent decades. In addition, the profit-oriented economic growth and development model adopted by countries is focused on increasing profits, while nature is being ignored.

To address these challenges, a novel paradigm has emerged that integrates environmental concerns into economic decision-making, ensuring sustainable natural resource management, safeguarding the rights of both present and future generations, and promoting development. Consequently, to achieve sustainable production and management of resources, it is imperative to develop new, safe, low-cost, eco-efficient and knowledge-based products. These products must support competitiveness and sustainability, while concurrently contributing to the economy through biotechnology. This approach aims to enhance health, increase agricultural and forestry yield and

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quality, and achieve sustainable improvements in environmental issues. In this context, the objective is to formulate policies for the implementation of innovative, high value-added, production-oriented bioeconomic approaches by protecting natural resources and ensuring their rational use in ensuring the sustainable development of countries.

Key Words: Sustainable Development, Bioeconomy, Circular Bioeconomy

Introduction

The increase in environmental problems and the nature of these problems has revealed the fact that the struggle against environmental problems cannot be carried out on an individual and national basis. Indeed, it has become apparent that it is possible to seek solutions with a global consciousness and solidarity. The first steps of this struggle process from a global perspective were found in the declarations and international agreements prepared at the environmental conferences organised under the leadership of the United Nations. The national strategies of the countries also played a role in this process. It is imperative to acknowledge the fundamental human need to access and procure the sustenance necessary for optimal health and nutrition.

The imperative for the development of agricultural policies is twofold in the contemporary global context. On the one hand, there is a need to protect natural resources in the face of a growing population and the limitation of these resources. On the other hand, there is a need to establish production systems and supply chains to meet the food needs of the increasing population. The strategic importance of water, energy and food, which are the basic inputs and outputs of agricultural activities, is set to become a cause of war in the near future. The interconnected challenges of climate change, pandemics, economic and social disparities, population growth, income inequality, and conflict have converged to jeopardize global food supply security. In this context, the imperative for action has become paramount, prompting a worldwide acceleration in the formulation of sustainable development policies.

By 2030, it is projected that the demand for fossil fuels will escalate by 44% in the absence of initiatives to develop substitute resources for existing natural resources, as outlined in a report by the International Food Policy Research Institute (IFPRI). The report anticipates a 70% surge in food consumption by 2050, a 80% escalation in red meat consumption, and a 52% increase in cereal consumption, all in response to the projected expansion of the global population. The Organisation for Economic Co-operation

and Development (OECD) report further predicts that failure to implement global changes to food policies will result in a 55% increase in global demand for water, with a concomitant prediction of a 70-90% increase in water usage in agriculture. The OECD report further anticipates an increase in the Gross Domestic Product (GDP) of OECD countries by 2.3% and 4.6% in developing countries by the year 2030. Additionally, it is projected that the share of biochemical products in total chemical products will reach 35%, while products produced using biotechnology are expected to account for 50% (Sheppard, Gillespie, Hirsch and Begley, 2011).

In consideration of the aforementioned data, it is evident that the most prudent course of action for nations to pursue is the transition to a bioeconomy. This term, which signifies the integration of economic activities with principles of sustainable development, has witnessed a considerable surge in recent times. Developed countries have demonstrated a keen awareness of the imminent challenges and have initiated the production and implementation of bioeconomy-oriented policies. The overarching objective of the bioeconomy is to generate economic benefits through the production of surplus value from biological resources by employing methodologies such as biotechnology. The overarching objective of the bioeconomy is to mitigate the repercussions of health, agriculture and industry efficiency, sustainable biological resource management, alternative renewable energy, food security, climate change and global warming.

The concept of sustainable development is based on the idea of meeting everyone's basic needs and expectations for a better life, while protecting the resources of future generations. Sustainable development is a form of development approach based on a balance between the environment, economy and society within the scope of realizing human development goals and the continuity of natural resources that make human activities possible. For sustainable development, it is necessary to ensure sustainability in production by preserving the ecological balance. The concept of bioeconomy has been emphasized in recent years for a production model that is sustainable and observes ecological balance.

Sustainable Development and Bioeconomy

The world population is currently approximately 8 billion (worldometers.info). According to a report prepared by the United Nations, it is expected that the world population will increase to 9.3 billion people by 2050, 16% of whom will be over the age of 65, the food requirement will increase by 70%, and 40% of the population will have water problems. According to a

report published by the International Food Policy Research Institute (IFPRI), the consumption of grain is projected to rise by 52% by 2050, while the consumption of red meat is predicted to increase by 80%. In the absence of a global shift in food policies, a report by the Organisation for Economic Co-operation and Development (OECD) projects a 55% increase in global water demand and a 70-90% increase in water usage for agricultural purposes (Arısoy and Avcı, 2020).

By 2030, it is predicted that the demand for fossil fuels will increase by 44% if alternative resources to existing ones are not developed (Demir, 2021). The consumption of fossil fuels has given rise to a number of problems, including climate change, acid rain, oil spills, health concerns and pollution. Greenhouse gases, which are the primary cause of global warming, are produced as a result of the combustion of fossil fuels, such as coal, oil and gas. The consequences of global warming are manifold, including glacier melt, climate change, sea level rise and drought. In this process, the importance of a bioeconomy that is sustainable and manages resources effectively is significant (Avcı, 2019). In recent years, the adoption of a knowledge-based and environmentally compatible production approach by various sectors, coupled with advancements in biotechnology, has been instrumental in the adoption of the bioeconomy approach by countries and international organisations, and in the development of their strategies.

The bioeconomy has emerged as a pivotal strategy for developed countries in pursuit of sustainable resource utilisation, with Germany and Scandinavian countries serving as notable exemplars. While the bioeconomy constitutes 6.6% of Germany's economy, the figure stands at a substantial 10% for the Scandinavian countries (Demir, 2021). Despite the heterogeneity of definitions for the bioeconomy, it is generally understood to denote a knowledge-based, high-value-added production and utilisation of biological resources through the application of technology to provide products, processes and services in all economic sectors within the framework of a sustainable economic system.

The most significant benefits of the bioeconomy are biofuels and bioenergy, which are of particular importance when considering the increase in energy demand due to population growth. These environmentally friendly renewable resources are vital for the socioeconomic development and supply security of countries, as well as for the generation of heat, motor fuel and electricity. They also provide resource diversity to countries. The bioeconomy aims to achieve sustainable development through cooperation between all stakeholders involved in the process, including research and

development organisations, policy makers and entrepreneurs. Moreover, the bioeconomy exerts a pivotal function in the accelerated propagation of innovative practices by fostering entrepreneurial endeavours, amplifying competitive pressures across diverse sectors, and establishing sustainable interaction networks. Consequently, the demand for services such as food consumption, health, medicine, clean water, and clean energy experiences an inevitable escalation in response to population growth. The bioeconomy is regarded as an economic paradigm capable of generating alternative solutions to address these needs and optimise resource utilisation.

It is possible to list the benefits and objectives of the bioeconomy as follows (Demir, 2021).

- To create positive value and contribute to the economy by ensuring sustainable improvement of the environment,
- To reduce the ecological footprint of primary production and the supply chain as a whole,
- To obtain new, safe, lower cost and eco-efficient (using less waste, resources and energy) products,
- To provide a knowledge base for sustainable management, production and utilisation of biological resources,
- To ensure sustainable development,
- Innovation,
- To increase the competitiveness of related sectors,
- Reducing environmental damage by using biofuels,
- Production and utilisation of renewable resources,
- Development of low emission production systems,
- Reducing the impact of climate change, pollution and global warming,
- To increase quality and efficiency in the health, energy, agriculture and forestry sectors.

In order to realise targets set out in the bioeconomy, sectors such as agriculture, fisheries, food, forestry, biofuels and bioenergy must be considered, as they directly create added value. In contrast, sectors such as chemistry, textiles, plastics, pharmaceuticals, biotechnology, waste disposal and management provide indirect benefits. This is due to the fact that the aforementioned main sectors are related to biodiversity, which directly affects human welfare and life support systems. It is therefore vital to consider

that biodiversity constitutes the raw material of the sectors and ensures the continuity of production. Conversely, indirect sectors, encompassing services derived from the utilisation of biological resources, are contingent on the production processes of biodiversity and the employment of technology in these processes. The bioeconomy is regarded as a strategic sector that engenders added value within both national and international economic systems, with biodiversity being recognised as a guarantee of the sustainability of this sector (Demir, 2021).

In a world undergoing rapid and profound transformation, there is an increasing demand for novel solutions to the prevailing environmental, social and economic challenges. In response to this call, a range of approaches has been developed, underpinned by the concept of sustainable development. The bioeconomy has emerged as a pivotal force in this landscape, offering alternative renewable and sustainable solutions that are pivotal in achieving the Sustainable Development Goals.

The common benefits of sustainable development for all, including future generations, can be summarised as follows:

· Reduced environmental impact

· Achieved balance between humanity and nature

· Ensured equal opportunities

· Constructed fairer societies

· Efficient use of resources

· Waste prevention and cost savings

The bioeconomy is a paradigm shift in the way local, regional, and national economies are conceptualised, thereby giving rise to novel roles and responsibilities for companies, governments, and other institutions to meet societal expectations (Wozniak, Tyczevska and Twardowski, 2021). Strategies for the bioeconomy are not solely focused on economic development and job creation, but also on social development. While developing countries such as Brazil, Indonesia and South Africa are placing greater emphasis on social inclusion and the strengthening of rural communities, industrialised countries are focusing more on social transformation. For instance, Norway aspires to establish a ‘biobased society’, while Sweden aims to create a ‘sustainable society’. In this regard, numerous policy strategies acknowledge the necessity for alterations in consumption choices and patterns. However, these strategies do not delve into the intricacies of these issues and are

constrained in their capacity to raise awareness (Fund, El-Chichakli, Paterman and Dieckhof, 2015).

The bioeconomy has been demonstrated to increase the competitiveness of countries in global markets. The export of biotechnological innovations and the sustainable management of biological resources have been shown to contribute to the economic growth of countries. The bioeconomy has been established as a model that provides economic, environmental and social benefits in line with sustainable development goals. This model has been shown to contribute to long-term economic growth by promoting the efficient and sustainable use of biological resources. The bioeconomy sector has been demonstrated to create new job opportunities in areas such as agriculture, biotechnology, renewable energy and bioplastics.

It has been demonstrated that this contributes to economic development by increasing employment in rural areas. The utilisation of agricultural waste in the production of biogas and biofuel provides farmers with additional income and creates employment opportunities in this field. Furthermore, the use of waste from biogas production as organic fertiliser has the potential to generate new employment opportunities. Finally, research and development (R&D) activities in universities, research centres and biotechnology companies have been shown to create employment opportunities for scientists and engineers (Yavuz and Tümenbatur, 2022).

The bioeconomy sector contributes significantly to the economic development of countries, while also supporting environmental sustainability and social welfare. New job opportunities created in these areas accelerate regional development by providing economic opportunities especially for people living in rural areas.

Research and projects in the field of bioeconomy play an important role in raising environmental awareness in society and promoting sustainable lifestyles. Training programmes and public awareness campaigns in this field help individuals to exhibit more conscious and sustainable behaviours by increasing their environmental sensitivity (Ünal and Kızılaslan, 2014).

Following the adoption of the 2030 Agenda for Sustainable Development by the United Nations in 2015, the relationship between the Sustainable Development Goals (SDGs) and the bioeconomy has strengthened, as the bioeconomy is increasingly valued for its contribution to achieving the SDGs. This global role, as well as those in national and regional strategies, has resulted in the bioeconomy being part of the SDGs' traceability. This has resulted in the relevant actions of the SDGs being included among the

parameters investigated in the models created to monitor the bioeconomy in the studies examined (Maximilian and Dušan 2021). The Sustainable Development Goals (SDGs) are a series of objectives established by the United Nations (UN) with the aim of addressing global challenges, including poverty, environmental protection, climate change, and the promotion of peace (United Nations, 2015). The potential for bioeconomy innovation, environmental protection, value-added production, competitiveness, and sustainability to contribute to the realization of these goals is a subject of ongoing research.

In order to ensure sustainability in development, it is necessary to analyse growth in environmental, social and economic terms. In this context, the utilisation of the bioeconomy in production, management, financial markets, marketing, politics, technology, energy, health and many other areas of bio-resources is required. The bioeconomy is poised to yield substantial benefits, ranging from sustainable production to the valorization of waste, from the mobilisation of financial resources to the assertion of influence in global markets (Karakayacı and Korkmaz, 2025).The implementation of the bioeconomy, an innovative, environmentally protective, sustainable, and value-added-generating initiative, is set to play a pivotal role in the adaptation to sustainable development, within the ambit of specific policies.

The European Union published its bioeconomy strategy in 2012 and updated this strategy in 2018, taking into account the circular economy approach. The term ‘circular economy’ is defined as ‘the sustainable, gradual processing of biological residues into biobased products that can be shared, reused, reproduced, recycled or safely released into the biosphere through organic and nutrient cycles’ (Mohan, Dahiyaa, Amulyaa, Katakojwalaa and Vanitha, 2019). The circular economy aims to reduce or reuse the use of natural resources, reduce the burden on the environment, reduce inputs and minimise waste production. In order to ensure sustainable development, the circular economy ensures the reuse, recycling, reduction or renewal of materials in the process from production to consumption at micro and macro levels. Thus, environmental quality, economic welfare and social equality will be ensured for present and future generations and sustainable development will be successfully realised (Yılmaz, 2019).

The fundamental principles of the circular economy emphasise the reduction of raw materials sourced from natural resources, favouring instead the reuse, renewal, evaluation and redistribution of resources within a closed-loop system. This approach is designed to minimise the release of waste from the system. The fundamental principles of the circular economy are

collectively referred to as the 4Rs, an acronym derived from the initial letters of the English words that represent them: waste prevention and reduction (reduce), reuse (reuse), recycling (recycle) and recovery (recovery; especially in energy).

The concept of a circular bioeconomy posits that the concepts of circular economy and bioeconomy, which are interconnected in numerous ways, can be operated in a concurrent manner. The joint implementation of these concepts as a systemic common approach is hypothesised to increase resource efficiency and assist in reducing environmental pressures (Carus, 2017). In terms of circular bioeconomy and sustainability, the healthy and safe recovery of waste and the effective and efficient use of renewable biomass are also deemed to be important. A comprehensive circular bioeconomy system can be delineated as a wholly bio-based 'circular carbon economy', with the objective being the sequestration of atmospheric carbon emissions by natural vegetation and biotechnological and analogous strategies, thereby achieving a zero-emission target. Achieving a circular bioeconomy necessitates a comprehensive reconstruction of existing economic systems, including the establishment of partnerships between sectors concerning the utilisation of biomass, recycling, and the concurrent production of goods and services. Furthermore, land, sea, and forest utilisation require re-planning at the local, national, and regional levels, with consideration for evolving climatic conditions.

Sustainability includes a large number of criteria and indicators, and due to the economic, ecological and social aspects of these indicators, impact measurement tools are gradually developing towards holistic measurement (Karvonen, Halder, Kangas and Leskinen, 2017). In the sustainable circular bioeconomy, not only economic measurement tools such as cost-benefit analysis are used, but also measurement tools that can encompass environmental and social impacts as well as economic.

Conclusions and Recommendations

The pursuit of industrialisation and economic growth, the rise in global population, the expansion of the globalisation network, and the rapid transformation of production and consumption patterns have exerted significant pressure on the environment and natural resources, thereby contributing to environmental degradation and resource scarcity. Within the consumption model, the ever-increasing demands of humanity and the dwindling supply of natural resources have led to a growing reliance on imports. In this context, novel economic initiatives have gained traction within

the EU, centring on the concept of a sustainable environment and adopting a sustainable development approach. Recently, novel economic models that have gained traction on international platforms have emerged, such as the green economy, the low-carbon economy and the circular economy.

It is imperative to acknowledge the concept of sustainable development in order to identify solutions to the prevailing environmental, social and economic challenges. The bioeconomy, a pivotal element in the pursuit of sustainable development, is defined as the integration of economic activities with environmental sustainability. This concept encompasses a production model that prioritises sustainability and ecological balance. The bioeconomy, characterised by the utilisation of biomass through biotechnology, offers significant opportunities to countries seeking to enhance natural resource efficiency, reduce reliance on fossil fuels, sustainably manage biological resources, and diversify renewable energy sources. The bioeconomy's notable advantages have garnered global attention, particularly in Europe, where the European Union has recognised it as a pivotal growth model and strategy. In this regard, numerous countries, notably developed nations, have established bioeconomy policy and strategy frameworks or initiated preparatory studies. The investments made by developed countries in the bioeconomy, and the sector's share in their respective economies, are on an upward trend.

It is vital to increase investments in bioeconomy-based projects in order to accelerate the development of this field. Particular emphasis should be placed on incentivising projects such as biogas plants and bioplastic production. Furthermore, it is essential to allocate additional resources to research and development activities, with the objective of developing innovative solutions in collaboration with universities and the private sector. Universities should be encouraged to conduct more research in the fields of biotechnology and renewable energy. Public awareness of the bioeconomy should be raised through the organisation of training programmes.

It is vital to direct young entrepreneurs to this field in order to contribute to sustainable development in the long term. It is imperative to remove legislative barriers to bioeconomy-based initiatives and to develop supportive policies for initiatives operating in this field. Incentivising companies operating in the field of bioeconomy in countries will contribute to the growth of this sector. International cooperation should be increased in order to benefit from successful bioeconomy examples worldwide.

Furthermore, the collaboration between developing countries and leading bioeconomy nations in the field of knowledge and technology transfer is expected to accelerate the development of the latter in this sector.

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CHAPTER 4

GREEN MARKETING STRATEGIES: FACTORS AND PRACTICES SHAPING SUSTAINABLE CONSUMER BEHAVIOR

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Abstract

In today's world, due to the increase in environmental awareness, businesses aiming to meet consumers' expectations have made green marketing an indispensable strategy to ensure sustainable compliance. This study specifically addresses sustainable supply chain and digital marketing studies implemented in the development of environmentally friendly consumption models. Despite consumer skepticism, high production costs, and the challenges brought by legal regulations, companies are showing an increasing tendency towards green marketing. In this sense, the study examines the literature and emphasizes how green marketing strategies are implemented to ensure long-term consumer trust from global brands to small businesses. In addition, based on the findings obtained from the literature review, it is understood that green marketing strategies not only increase the brand reputation of companies but also make a great contribution to environmental goals, such as reducing carbon emissions and preventing waste. It is thought that this study, which addresses marketing and sustainability together, will provide valuable insights for businesses, lawmakers, and

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researchers. As a result, the increasing awareness of consumers towards environmental awareness makes it mandatory for businesses that want to find a place for themselves in the increasingly competitive environment to carry out environmentally sensitive and ecological activities.

Keywords: Green Marketing, Consumer Behavior, Sustainability, Marketing Strategies.

1. Introduction

The awareness that has emerged among consumers in the face of negative environmental effects such as unplanned urbanization, intense migration, climate change, and rapid pollution of used natural resources, and the changes in behaviors that have developed accordingly, have forced organizations to make changes by reconsidering all parts of production, marketing, sales and management from the very beginning, and to use different solutions and different management philosophies. Again, since the competitive conditions, which are seen to have a great impact today, have become more difficult as a result of globalization, all organizations can't catch up if they fall behind in keeping up with this. Compared to previous periods, organizations are in greater communication with external and internal environmental elements to carry out their activities. Therefore, the strength of the organization is directly related to how it manages its environmental relations and resources. For this reason, it is a fact that organizations that remain insensitive to behaviors related to ecology and related issues that have developed in recent years will enter a detrimental position in their development and activities after a certain time.

Total quality management and lean management, which have left their mark on the last 30-40 years, continue to exist as another issue that organizations that want to survive pay attention to. Green marketing, which is a newer concept, is a kind of intermediary factor in the acceptance of both lean management and total quality management. The strategies applied in green marketing support lean practices that create a kind of institutional performance-enhancing effect in creating a better working environment for organizations. In return, lean management, although not emphasized, has positive effects on green management in return for reducing activities that will reduce inefficiencies in terms of environmental pollution. As another factor, it should not be forgotten that total quality management also benefits greatly from green marketing to empower employees as a result of service or product improvement in its structure. Because with the green strategies

to be applied, it is possible to reach the lowest costs and provide the highest quality goods or services in the shortest time.

Recycling activities, which are seen as an important factor in green management and marketing, also provide great benefits in reducing environmental pollution, reducing waste amounts, saving energy and protecting natural resources. It is known that every unit increase in energy efficiency contributes to a decrease in organizational costs. Reusing previously manufactured materials through recycling helps to reduce stock costs and reduce expenses and budgets in new product purchases. It should not be forgotten that organizations that use green marketing practices are now turning to renewable energy investments, which will create the highest level of competition in supply chain management, will also affect transportation costs in terms of decreasing. Since it is known that raw material and energy costs have increased globally in today's economic system and will continue to increase in the future, the fact that it is not known to what extent it will affect the production costs of enterprises in the future shows that enterprises must definitely implement green marketing strategies in the context of their sustainability. When the population growth rates of developing countries are examined, it is thought that the levels of gross national product per capita also increase the demand for renewable energy. However, unplanned use of every renewable energy can negatively affect the protection of globally available resources and can put businesses and suppliers, especially those with international investments, in a difficult position.

On the other hand, in order to leave a cleaner world for the new generations, there are also situations where concerns about environmental issues have increased, civil society organizations have increased their work, and consumers can pay more for natural and organic products. Organizations also need to exhibit relatively more environmental protection behaviors in addition to their general purpose of making a profit and show that they take corporate responsibility in this regard. In fact, the rising awareness on environmental protection issues, although not very strong, has been remembered for a long time. Green marketing is on its way to becoming the strongest commercial and social factor of the new era in this sense. This concept, which was used in the past to find alternatives or solutions to resource pollution and was defined as ecological marketing, has increased especially after the 2000s with the concept of sustainability, while affecting a wider mindset and increasing its power with the discussions and practices it creates.

When considered as a process, perhaps it can be said that the sustainability phase of the green marketing concept is being experienced today. Sustainability as a concept is a general phenomenon consisting of environmental, economic and social development dimensions. This phenomenon is also at the intersection point of the so-called future technologies engineering sciences and social sciences. The process that costs organizations more than keeping old customers is gaining new customers. For this reason, organizations benefit from green marketing strategies, which are the latest trend and are seen as positive, to increase their sales rates. In this way, it is possible for them to both keep their consumers and gain new customers by offering customized and high-level goods or services.

When the situation of limited resources, which is constantly explained, and the position of endless needs are considered in the axis of sustainability, it should not be forgotten that in addition to all individuals fulfilling their responsibilities, businesses, and institutions also have important duties. In addition to being explained, the green marketing approach should be adopted in detail by all stakeholders, it should be explained that it is a kind of lifestyle and this period, when radical changes are needed, should be supported with the positive effects of the green image. It should not be forgotten that organizations that are introduced as environmentally friendly today have established superiority over their competitors in terms of gaining the trust of consumers and have gained significant advantages in the markets in which they operate.

2. Green Strategy Concept

When we look at the concept of strategy before the concept of green strategy, Knox (2012: 197) explains that strategy is related to making longer-term goals and objectives and implementing them as a result, while stating that shorter-term goals and objectives are related to the concept of tactics. Green marketing strategies are seen as a type of business strategy where there is awareness about environmental issues, organizational policies and practices are implemented at a high level, and then more innovative programs are used. The benefits of green strategies include reducing environmentally harmful waste, cost-effectiveness resulting from eliminating it if possible, supporting programs aimed at increasing organizational performance, brand awareness, and energy saving. Chen and Chang (2013: 65) mention that organizations apply green marketing strategies to determine the green needs of consumers, introduce relevant green products, segment the relevant green

market differently, provide competitive advantage within market conditions, create differentiation policies, and implement the green marketing mix.

It is possible to implement green marketing with the participation of all affiliated parts of organizations to meet consumer needs and focus strongly on their values. D'Souza et al. (2015: 601) mention that as a result of better adoption of green marketing strategy in businesses, the business can be reoriented, can adapt to rapidly increasing consumer demands and dynamic market conditions, how customer targeting types, market offers can be supported and how green initiatives can be used to create a sustainable advantage in the competitive environment. In addition, Shi and Yang (2018: 78) mention that the implementation of green marketing strategies in organizations means understanding how to initiate and organize relevant green studies, how to define the targeted consumer audience, and how market resources can affect green studies to create a sustainable competitive force.

3. Green Marketing Strategies

There are some ways that organizations can follow green strategies to meet the needs of some of their stakeholders to achieve their goals. It is possible to mention three main strategies green innovation, green alliances, and greening of organizations. The first strategy that is used the most is the development of new green products or services. In this type of strategy, the behavior gives positive signals to all stakeholders that the relevant organization has adopted a green structure. Another widely used strategy is that the organization focuses on the environmental parts of its internal dynamics. In such strategies, businesses focus on the fact that they benefit from greening in the processes of providing the goods or services they produce. In green goods or services that are remanufactured, beyond greening the processes of production or the organization, the business may also go on the path of establishing partnerships or alliances with other organizations to further develop such green orientations. This behavior is another sign that organizations that do this have chosen the green marketing method. Cronin et al. (2011: 163) mention that organizations should research to understand which strategy can be effective in terms of influencing the green business orientation.

According to Chamorro and Banegil (2006: 13), a set of marketing actions created to meet the demands of consumers in the target market without causing damage to the environment is called green marketing. According to the American Marketing Association, the further development and promotion of products that are considered environmentally safe is called

green marketing. In this sense, organizations that accept the green marketing strategy aim to meet the demands of consumers by using their natural resources most beneficially and efficiently. The green product mentioned here refers to all goods or services produced in an environmentally friendly manner in areas defined as target markets by organizations. According to Risteska (2023: 122), consumers are becoming conscious of green product issues thanks to the increasing awareness in our age. Here, the distribution part of green marketing is defined as a very sensitive process, and it is stated that distribution affects the purchasing behavior of consumers and positively increases consumer purchasing behavior if timely distribution is made to customers.

Green marketing, which can also be explained as ecological, environmental, sustainable, and social marketing, is a term introduced by the American Marketing Association in 1975, according to Zhu and Sarkis (2016). However, according to Polonsky (2008), as a subset of marketing, it consists of three main components and a broad concept that evaluates positive and negative activities and examines environmental problems. Green marketing, which covers the period of adding environmental awareness to marketing management, aims to create awareness to use the elements that are the shining mix in organizations in a way that will not harm the environment. According to Polonsky (2008), in addition to these, it is explained as the examination of how the resources connected to the marketing activities created in the process of meeting the demands and needs of individuals with the constantly stated scarce resources are used. According to Stanton (1991), green marketing is explained as organizations continuing their interactions with their environment in a more harmonious way in their activities. In another definition, Walker and Hanson (1998) define green marketing as marketing practices that arise from activities and are affected by environmental fears. Fuller (1999) explains green marketing as the period of implementing and controlling marketing mix supplements to meet consumer needs in line with the natural ecosystem. Sharma et al. (2010) explain green marketing as a marketing method that includes the activities of realizing environmentally friendly requirements management planned to achieve sustainable competitive advantage by focusing on environmental priorities. When all definitions are examined, it is understood that the aim is to reduce or eliminate the negative effects to be given to the environment in all the work that can be done. According to Alsmadi (2007), green marketing is defined as the implementation of all marketing activities aimed at realizing environmentally friendly requests and creating behavioral consumption patterns accordingly within a kind of environmental responsibility

framework. In addition, Papadas et al. (2017) address environmental problems such as the consumption of more resources, energy consumption, the ecosystem being in a difficult situation, and the extinction threats of some species. According to Polonsky (2008), there are five possible reasons why organizations benefit from and use green marketing. First, it is stated that organizations see green marketing practices as a kind of opportunity to reach their goals. Second, it is the belief that it is a moral obligation for organizations to carry out some environmentally friendly activities within the framework of a kind of corporate social responsibility. Third, it is shown that organizations must continue their work with a sense of responsibility towards the environment thanks to the legal sanctions of the states. Fourth, it is stated that competitors force organizations to develop green marketing activities within the scope of their environmental activities, while fifth and lastly, it is shown that organizations are forced to change their behaviors due to the high-cost elements related to the methods used for the efficient use of resources.

According to Ottman and Books (1997), green marketing is defined as the contribution of businesses to society and the environment with sustainable development through satisfactory living conditions and improved organizational performance. Cherian and Jacob (2012), on the other hand, examine the consumer characteristics of green marketing in their research and mention that green marketing practices should be used especially for target audiences in the formation of positive environmental contributions created by green businesses and in the preference of their goods or services. Accordingly, it is stated that the green marketing to be implemented will contribute positively to increasing awareness about environmentally friendly activities. Kaufmann et al. (2012) stated in their study that the green marketing activities to be implemented will contribute to a more sustainable future with the increase in environmentally friendly movements.

Green innovation of a product or service can be defined as the production or assimilation of a new type of business management of the production process, service, or management. The criterion for defining an innovation as green is that its use harms the environment less than the use of its alternatives. All new processes called resource efficiency are shown as green innovation. The definition of green innovation here is mostly based on a total assessment of environmental impacts and risks, according to Kemp and Pearson (2007: 6). Cronin et al. (2011: 164) have detailed the greening of businesses in six sub-dimensions as waste reduction, green champions, system certification, green processes, chain construction, and chain management.

Another green marketing strategy is green alliances, which are official or unofficial collaborations between more than two organizations aimed at finding common solutions to environmental problems. Here, it is mentioned that alliances can be established between the organizations described and civil society organizations or governments. According to Crane (1998: 560), while the narrow sense of organizations only collaborating between businesses and environmental groups is defined, two different ways of broad-sense green alliances are mentioned. First, alliances made according to the types of partnerships are shown, while in the second part, collaborations are defined according to the level and structure of interactions between partners.

Green communication also has an important place in green marketing strategies. Green qualities reveal real environmental benefits. Therefore, it is important for consumers to trust the statements of suppliers that they are environmentally friendly, and for sellers to disclose information that gains the trust of their consumers. The aim here is to convey the implemented environmentally friendly policies to the target audience and stakeholders and consumers who are at the center of the entire business structure. Today, newspapers, brochures, magazines, and more importantly the internet and social and general media are used in this communication. According to Solvalier (2010: 17), there are two types of green communication, namely sustainable green communication and unsustainable green communication, which positively or negatively affect accessibility, information acquisition, trust, and metaphors.

In transportation and logistics, which are indispensable for all organizations, green management is also seen as a kind of marketing activity. In the eyes of consumers, the transportation sector is also seen as one of the biggest factors affecting environmental degradation, both in terms of its type and infrastructure. In contrast, the developing logistics section is also seen by many people as an opportunity to offer more environmentally friendly suggestions and solutions to the transportation industry. Today, while traditional logistics organizes the processes that require utilization of storage, distribution, packaging, control, and stock management from producer to consumer, it has started to transform into a different sub-sector by creating new markets for the recycling and disposal of environmental elements. This reverse distribution is called reverse logistics, which consists of the transportation of a kind of waste and the movement of used materials. According to Rodrigue et al. (2001: 2), the addition of logistics to the concept of recycling and the disposal of all different waste materials, including hazardous goods, is becoming a new big market and the aim of logistics related to this is actually to reduce transportation costs. Time

has a very important place in logistics services. As a result of reducing the flow time in transportation, the speed of the distribution system can be increased and efficiency can be increased. In addition, service reliability is also very important in the logistics sector. Therefore, deliveries made within the specified periods with the least threat of damage and breakage are considered success criteria. Rodrigue et al. (2001: 5) mention that logistics affects reducing environmental damage as an important element supporting international trade flows and strengthening globalization.

Another green marketing activity is green pricing which is used more for electrical energy obtained from clean and environmentally friendly sources such as wind, biomass, solar, hydro energy, and geothermal. It is known as an environmentally friendly product that shows that electrical services can meet consumer demands. In addition, the fact that consumers who prefer the relevant product pay a price difference for using electricity that causes less environmental degradation can be shown as a different feature. The price difference mentioned here does not mean that renewable energy is more expensive. The relevant price difference consists only of the difference between the lowest cost and a plan that includes more renewable energy. According to Holt and Holt (1997: 6), with green pricing, the benefits that arise from renewable energy rather than from cost-effective goods or services are explained as the most important and not to be considered part of the cost.

The importance given to the sustainable development of the goods or services produced has made it necessary for the engineers concerned to consider the environmental aspects at the same time as other traditional technical and economically shown parts. Therefore, green design as a different green marketing strategy is seen as an approach that can reach the strongest results in the development stages of the products. The most general one among the many definitions made especially in recent years is shown as the ISO 14006: 2011 standard. Green design can be explained as an activity that aims to address all the processes from design to development and integration together to reduce the negative environmental impacts of a product throughout its life cycle. Accordingly, Fargnoli et al. (2012: 870) mention that after-sales maintenance and after-sales services undertake an important task in maximizing both consumer satisfaction and the environmental performance of the relevant product along with its general life cycle.

Green segmentation, i.e. segmentation and targeting, are closely related concepts. Market segmentation here refers to the process of distributing the target market into customer groups with different needs, characteristics, and

behaviors. Rex and Baumann (2007: 572) state that during the targeting period, these sections are evaluated and the organization decides which segment it should address. Greenmarket segmentation, in addition to all these, consists of several variable or characteristic selections used to divide consumers into homogeneous groups. Do Paço and Raposo (2009: 366) mention that the resulting distributions can be easily defined with references created thanks to easily observable defining characteristics such as geographical location or demographic characteristics?

Another method in green marketing strategies is green positioning. The main function of brand positioning is explained as the organization's offers, status, and reputation to be in a distinctive place in the customer's mind for the selected target market. According to Wang (2017: 1460), green positioning is the brand strategy that affects the perceptions of target customers regarding the green initiatives of the relevant brands and forms the basis for the relevant brand to be in a different position from its competitors. Brand positioning is considered a process consisting of effective, planned policies aimed at defining the perceptions of different types of consumers and is repeated. As a result, according to Hartmann et al. (2005: 10), green positioning is based on the communication and interaction of all marketing tools with a mission focused on marketing communications due to its effect on the process of shaping different consumer perceptions.

4. Consumer Behavior

Consumer behavior is the sum of behaviors that cover all decision-making periods regarding the supply, use, and subsequent consumption of goods or services (Yemez and Akça: 2024). Today, the concept of sustainable consumption behaviors, which mostly affects and changes customers' purchasing decisions and reshapes their habits, has become more prominent. In such behaviors, studies such as extending the life of used products, increasing sustainability in the sharing economy, and on the contrary, using unused and limited resources more effectively are seen. The main purpose of this type of consumption is to direct consumers to a relatively healthy and sustainable lifestyle by choosing more sustainable products. According to Mortensen (2006), sustainable consumption is explained as reducing the damage to the environment and not consuming natural resources as much as possible while meeting the demands and needs of current and future generations. Two distinctions are generally mentioned in the literature on this concept. While some researchers only define sustainable consumption, one examines both the excess use in sustainability and the production processes

together. The main reason here is that both consumption and production are considered as an inseparable whole as a concept. According to McLaren (2007), some alternatives have been developed for the full implementation of the concept of sustainable consumption. The first of these options is shown as defining more environmentally sensitive consumption habits and reducing the consumption rate by directing people to consume as little as possible. The second way is to aim to increase the developments in the production of more sustainable goods or services in addition to changing consumer behaviors.

According to Yücel and Ekmekçiler (2008), while there used to be customers who only consumed by shopping, this current paradigm has changed thanks to the emergence of a segment called green consumers with more environmental awareness, the inclusion of used resources in the utilization of the consumption process, and the increased awareness in environmental pollution and waste management. According to Emgin and Türk (2004), green consumers who prefer products that are suitable for this new lifestyle and do not harm their surroundings have emerged at the focal point of commercial activity strategies called green marketing. According to Peattie (1995), people who use more environmentally friendly energy efficiently and consume natural resources that are known to be limited are green consumers. However, these green consumers also consider social and environmental problems when making decisions about consumption. This concept includes people who are sensitive about conscious energy use, health, or recycling, in addition to ecological balance. According to Rahbar and Wahid (2007), green consumers are individuals who do not harm both the environment and health, who use scarce resources as little as possible,e and who do not use products that use very high energy. According to Fraj and Martinez (2007), they mention that many researchers have explained that green consumer behavior varies according to socioeconomic factors, demographic factors, lifestyles, ecological fears, and values.

According to Karaca (2013), after the environmental marketing phenomenon was accepted in the commercial market, sub-concepts called “green” began to emerge and accordingly, the concept of “environmentalist consumer” emerged. The green concept used here is not only related to consumption but also follows the details of the process of using limited resources and the management processes of wastes formed after use. It is thought that consumers who are more ecologically conscious are individuals who can influence their surroundings with their purchasing decisions. Naturally, it is thought that such consumers make choices in their shopping, research the production processes of products in their purchasing behaviors, and take into account many factors such as the methods of using products

from raw material sources, waste processes after use, and negative effects on the environment. According to Yücel and Ekmekçiler (2008), while consumers used to be only interested in the purchasing and consumption parts, they mention that consumers with more environmental awareness are paying attention to the use of resources in the production processes and how wastes are disposed of. According to Odabaşı (1992), the behaviors of green consumers are organized to protect both the environment and their health. According to Boztepe (2012), in a study, the main characteristics of green consumers are explained as exhibiting exaggerated green behavior, making environmental protection easy, not trusting the environmental statements of companies, being young and adult, women choosing more environmentally friendly products compared to men, and mostly having sufficient spending power. In light of all these factors, the concept of consumer and consumer behavior are among the most difficult and complex elements to understand. According to İslamoğlu and Altunışık (2013), there are two important reasons for this difficulty: the difficulty of measuring and evaluating human behavior and the fact that human behavior is affected by internal and external factors. For this reason, consumer behavior can be explained as the definition of the process of people's decisions about where, how, and when to buy goods, services, or ideas.

The fact that environmental problems are increasingly on the agenda today is one of the signs that environmental awareness has increased. Another effect of the increase in the level of awareness in this section can be shown as increasing the level of anxiety in future generations. For this reason, Özcan and Özgül (2019) mention that these environmental concerns lead people to prefer environmentally friendly products. Because consumers make decisions under the influence of many social and personal factors. It is possible to classify these factors under the headings of psychological, personal, and social/cultural.

4.1. Personal Factors

Many previous studies have examined the relationship between demographic characteristics and environmental attitudes. Özcan and Özgül (2019), mention that this is because market segmentation based on demographic variables is seen as a more powerful and useful strategy by marketers. Cüceloğlu (2005) describes the phenomenon of how people's interactions with their external and internal environments are shaped in a structured and consistent manner that distinguishes them from other people as personalities. Personality varies in each individual, but it can also be divided into groups in terms of some characteristics. According to Şen and

Kozak (2013), as a result of these groupings, market adaptation is enabled, which supports the development of goods or services according to the target markets of organizations and the success of promotional activities.

The concept of gender can be mentioned as another demographic feature. Gender, which is effective in terms of its power in determining consumer behavior, also shows differences in the sensitivities of people of different genders in terms of colors and tastes. Therefore, it should be considered normal to see differences in the green product purchasing behaviors of women and men. It is understood from the studies conducted in terms of behavior and abilities that this situation can affect purchasing behaviors. Economic characteristics are another important factor affecting green product purchasing behaviors. Because financial power is quite effective in terms of general structure and economy in consumer purchasing behaviors. It can be understood that consumers' desires decrease due to the decrease in their purchasing power in periods of possible economic recessions. According to Demir and Kozak (2013), on the other hand, in more comfortable economic periods, the results can be seen differently since consumers' high purchasing power and overspending tendencies will increase. When the results of the studies investigating the interaction of consumers' environmental sensitivity according to the differences in their economic situations are examined, it is also seen that contradictory results can be obtained in terms of showing differences. While Özcan and Özgül (2019) stated in their review that some studies show that there is no positive significant interaction between ecological sensitivity and income level, they also mention that there are study results in which people with high-income levels approach environmental issues more sensitively than those with low-income levels.

Marital status can also affect consumption habits in different ways depending on both age and time factors. According to Aktuğlu and Temel (2006), people mostly consume to meet their own needs before marriage, while after marriage, they show changes in their purchasing behaviors depending on the new responsibilities of the family structure. Again, Kayapınar et al. (2018) revealed that the married participants showed more positive behavior towards green product purchases compared to the single ones as a result of their research. Among the demographic characteristics, the concept of age and life period can also lead to different results. The age at which people choose products and brands draws attention as an important factor. Since the interests and needs of all age groups are different, product preferences also vary according to age. Because the lifestyles of people of different ages are also different. Different lifestyles are also seen as differences in the goods or services they will demand. Consumer age has a great impact on marketers

in determining needs and trends. According to Cömert and Durmaz (2006), the biggest reason for this is that the physical, psychological, social, and economic characteristics of consumers can vary depending on their age. The concept of generation, which is used very frequently today, is a phenomenon that was grouped in very old periods. Accordingly, although the naming and grouping of age groups generally differ, four groups are generally mentioned as the main generation. People born between 1946-1964 are called baby boomers, and people born between 1965-1980 are called Generation X. Those born between 1980-1999 are called Generation Y, and people born in 2000 and later are called Generation Z. According to Karaman (2021), the negative attitude of the baby boomers, who are stated as the first generation, towards bureaucracy and their low-impact structure against purchasing green products are shown as their most important and distinctive feature. In another study, Kayapınar et al. (2018) examined the interaction between generations X, Y, and Z in terms of green product purchasing behaviors. The research revealed that Generation X consumers are more willing to purchase green products than the other two generations.

It is seen that lifestyles are also effectively taken into account among demographic characteristics. Lifestyle is a lifestyle that changes according to the resources of the person or family, the roles they have, their goals, needs, and demands. When examined in terms of consumption, lifestyles can also be seen as the way people use their belongings, personal time, and spaces. According to Altunışık and Nart (2000), lifestyle is shown as an important factor affecting consumers' lifestyles, habits, purchasing behaviors, and preferred goods or services, as it reveals how people spend their time and money within their consumption habits. As people's interest in social and environmental issues increases, conscious lifestyle preferences such as clothing and food have also begun to be seen in the foreground. The newest trend explaining this situation is the health and sustainability-oriented lifestyle or LOHAS for short. LOHAS is short for Lifestyles of Health and Sustainability, and it constitutes a market of more than 200 billion dollars in many areas such as alternative health services, organic foods, renewable energy, social responsibility investments, energy-saving vehicles, and devices. As a result of the research conducted by Yemez and Akça (2024), it was concluded that sustainable consumption behaviors are strongly positively affected by lifestyles. Finally, the professions and education levels of individuals are also shown in demographic characteristics. Education levels, environmental awareness, and environmentally sensitive purchasing behaviors can be shown as the most effective factors for consumers. With the increase in education levels in recent years, consumers' environmental

awareness and environmentally sensitive purchasing approaches can also increase positively. The direct purchasing power of consumers and their education levels are also in interaction. Therefore, as education levels increase, people's expectations and habits may differ. However, according to Şen and Kozak (2013), it will not always be correct to show the effect of education to fully explain consumption. Because the income earned after education is also in interaction with the quality of the education received. The social position of the consumers is also affected by their professions. The concept of profession is related to the income and purchasing power of individuals. The concepts of education level and occupation have a positive effect on green product purchasing behavior in this sense. In the research conducted by Yemez and Akça (2024), it was concluded that the green marketing activities of people with high education levels and businesses with such employees have positive effects on consumers' tendency to choose green products.

4.2. Sociocultural Factors

Factors affecting purchasing behaviors include concepts such as social class, roles, culture, and reference groups. Culture is one of the most fundamental factors that determine consumer behavior by affecting it. Because it refers to all the habits that an individual acquires as a member of the society they are in, such as art, knowledge, morality, tradition, and customs. According to Coşkun (2019), culture can be seen as a kind of personality of a society, and for this reason, it is not possible to draw its boundaries. A cultural system shows itself by influencing consumer behavior and shapes the behavior patterns, daily experiences, and consumption habits gained in the process. According to Erdem (2006), generally accepted value judgments within the social structure of a society can determine which product types are more valuable and which are less valuable.

Another factor is the concept of social class. The close relationships of those living in a society and the social structure consisting of people with the same expectations are defined in this way. Therefore, the social class can also significantly affect the purchasing behaviors of the relevant consumers. In addition, the social class that individuals target, apart from the social class they are in, also affects their behaviors and thoughts. According to Coşkun (2019), people generally strive to raise their social level to a higher class and can change their consumption habits accordingly.

Consultancy or reference groups are groups of people who can positively or negatively affect consumers' value judgments and thoughts. Today, all

individuals can be members of many different groups. For the social groups mentioned here to be effective as a reference group, they must be able to direct the behaviors of their members. The family institution is also effective as an important reference group. In addition, groups such as clubs, professional associations, and political parties can affect consumers in different ways. Here, reference groups affect consumers' information about products, their beliefs and knowledge about products, their experiences, methods of using products, which needs they will mee,t and all these determined effects while affecting the communication network within the group. In addition, families have become increasingly nuclear family structures towards the end of the 20th century and have become important in affecting behaviors in a way that is strong in communication and high in interaction. According to Cömert and Durmaz (2002), while it changes according to who is in the family's working life, the number of children, and similar internal factors, it can show its effects on the preferred products as a result of the aging of the members and the natural change of the oldest in certain periods.

4.3. Psychological Factors

Thirdly, psychological factors are defined as the effects that are completely formed by the inner worlds of individuals and direct their behaviors and decisions. The relevant factors can be defined as learning, motivation, attitude, and perception. Motivation is the effect that activates, maintains, and shapes people's behaviors. It is the basis of human behavior and the realities that explain why people do or do not do any behavior. According to Barış and Odabaşı (2012), motivations begin to show themselves as a result of people's needs, mental periods, and experiences. Therefore, it has a strong effect on consumers' choices and determines their behaviors toward certain demands.

Perception is mentioned as another psychological factor. Consumers' selection of meaningful ones from data, their organization, and interpretation is called perception. This concept, which is related to the monitoring of various factors that affect individuals' awareness of their surroundings, takes data from people, sounds, tastes, behaviors, and colors around them and gives them meaning. Today, the perception of any service or product in terms of need can vary from consumer to consumer. In a sense, this difference in perception stems from the differences in consumers' individual and environmental factors. Özcan and Özgül (2019) state that consumers' different demands and interpretations when purchasing a product are the result of how they perceive the quality, price, benefits, and experiences of the relevant product.

Changes in people's behaviors are explained as learning, and people's perceptions are shaped according to their learning. Learning plays a decisive role in the formation of individuals' values, behaviors, actions, and attitudes, and is influential in consumer purchasing decisions. Durmaz (2011) states that consumers gain experience and knowledge related to purchasing and consumption throughout the process and that businesses, in turn, need to guide consumers in learning their products to successfully market their products. The positive or negative attitudes individuals display in any situation they encounter are called attitudes. Attitudes, which mostly occur as a result of learning, can be changed, but are difficult. The comments consumers make about the goods or services they use in daily life completely reveal the attitudes of consumers. According to Mucuk (2014), consumers can display a positive or negative attitude towards the goods or services purchased, and as a result, this attitude can positively or negatively affect the purchase of the relevant goods or services in the following periods.

5. Factors and Practices Shaping Consumer Behavior in Green Marketing Strategies

According to Yemez and Akça (2024), the concept of intention is an indicator of individuals' mental preparation for the action situation and indicates the possibility of customers purchasing any product to purchase a green product. The factors affecting consumers' intention to purchase green products in response to green marketing strategies are shown below:

5.1. Environmental Concern

While it is expected that the products focused on purchasing will provide value for consumers, it is also thought that the relevant products should primarily meet the qualities to be offered and negate possible consumer concerns. Among the relevant concerns, environmental concern is defined by Yemez and Tuna (2021) as a factor in determining the current or future concerns of individuals about issues related to their environment and reveals the concerns that consumers think about various environmental situations. Since ancient times, many studies have been conducted on the environment and attempts have been made to define consumers who are sensitive to the environment. Kinnear et al. (1974) explained that consumers with high levels of environmental concern are more sensitive to the environment and show openness in reducing impacts and being prone to innovations. Therefore, environmental concern, which is explained in the form of consumers' evaluation of environmental concerns in an emotional sense, is often

combined with environmental sensitivity and is shown as a factor affecting the purchase of goods or services in organizations. It is seen that consumers who pay attention to environmental issues are more likely to acquire more information than others, and it is understood that the relevant situation indirectly affects environmental purchase intentions. For this reason, it is seen that consumers are encouraged to acquire more information about environmental impacts. According to Newton et al. (2015), it is understood that individuals with high sensitivity to environmental issues are willing to pay more for renewable energy and environmentally friendly goods or services compared to those with low sensitivity.

5.2. Social Value

Among the factors affecting consumer purchase intentions, the concept of social value is also considered an important variable. The status and social environments in which individuals are located shape both their attitudes and habits. According to Moisander (2007), it is stated that consumers whose friends and families pay attention to environmental values increase the rate of purchasing green products. Because social values are an important factor in the development of the social self-concept. According to Öztürk (2023), it is inevitable that individuals tend to be affected by the social values that show the behavioral characteristics of the social groups they try to join or are in.

5.3. Subjective Norms

Subjective norm is known as the social pressure to perform any behavior, in other words, it is shown as the social influence felt towards performing a certain behavior. According to Ajzen (1991), subjective norms are shown as the behavioral precursor of the theory of planned behavior and express the intense and heavy moral responsibility feelings towards adopting environmentally friendly and self-sacrificing behaviors. According to Mercan (2015), in subjective norms, which are divided into two parts descriptive and imperative, descriptive normative beliefs are shown as beliefs about whether individuals should perform a certain behavior, while imperative normative beliefs are defined as expectations or possibilities of the approval of individuals or groups accepted as references for certain behaviors. According to Karaca and Karapınar (2021), social pressure, which is the power of norms that guide consumers, is accepted as a factor that directs sustainable consumption by affecting both behaviors and intention to purchase green products as a result of many studies. Mercan (2015) mentions

the possibility that cultural factors are much more decisive than economic factors in the intention to purchase green goods or services and that green consumer behavior is strengthened.

5.4. Green Advertising Skepticism

The relevant factor shows the suspicion and distrust that consumers may have towards the promotion and marketing activities of environmentally friendly goods or services. With the rise of green marketing, the importance of studies conducted on this subject is increasing and it is understood that there is confusion among people regarding the green claims of many goods or services. Obermiller and Spangenberg (1998) state that the main reason for this confusion is that consumers make reliable and realistic inquiries about green advertisements. Consumers often think that the environmental claims used are either biased or exaggerated and therefore have difficulty in making the right purchasing decision. In advertisements where relatively exaggerated expressions are used, the use of expressions that are accepted as true in theory but are not accepted in practice raises doubts in many consumers about green marketing.

5.5. Value for Money

According to Biswas and Roy (2015), value for money is defined as the total evaluation of the benefits obtained from the relevant products and the level of meeting customer needs in consumers' perceptions of the prices of green products. Therefore, the value of money is shown as an important sign of green consumers. Green products are desired by consumers as goods or services that are less harmful to the environment, have performance for their price, and are expected to be better than standard products. According to Rex and Baumann (2007), what consumers want in short is to get value for their money since performance/price analysis is done. Green products may be high-cost when compared to traditional goods or services and this may lead to changes in customers' purchasing decisions and intentions. As a result of the research conducted, it is understood that consumers prefer to pay relatively more for green products, which they believe will be worth the price they pay, rather than sacrificing product quality. Therefore, consumers who pay more for green products expect more in return. In this case, it is necessary to convey the benefits of green products to consumers both effectively and accurately, to inform consumers about these issues, and to review the promotion and pricing policies of green products in their organizations. Buerke et al. (2017) state that pricing strategies that support sustainable value transfer increase

environmental awareness in consumers and create environmentally focused consumers who believe that they will get what they pay for environmentally friendly products. Therefore, studies show that green products are one of the factors that affect both purchase intention and value for money. Similarly, it is understood that consumers care about both the value provided by green products and their prices and that even if the relevant factors do not directly affect their purchase decisions, they affect their purchase intentions. According to Chen and Chai (2010), it is explained that consumers consider green products to be of relatively higher quality and can positively affect their purchase intentions by matching them with higher prices.

5.6. High Price

Gleim et al. (2013) state that it is known that green products are mostly sold at higher prices compared to traditional products and that this may cause consumers to experience a dilemma in choosing green products. For this reason, it is stated that consumers' purchasing power is effective in preferring green products. It is observed that low-income consumers have difficulty purchasing green products with high sales figures, whereas high-income consumers can allocate more resources to purchasing such products. Moser (2015) explains that high sales figures may have negative effects on the demand for green products and may be prevented. Again, as a result of the research conducted by Moser (2015), it is understood that consumers who see green product features as an advantage are willing to pay more and are willing to pay more. Based on this result, Koçer and Delice (2016) state that consumers are willing to pay more for products that are shown as environmentally friendly with ecological labels because they are of higher quality and have additional benefits compared to traditional products.

5.7. Product Accessibility

The situation where consumers can reach green products more easily and can easily find and purchase them is known as product accessibility. While it is accepted that the ease of access to green products has increasing effects on consumers' intentions to purchase the relevant products, it is explained that increases in accessibility also increase the possibility of consumers showing interest in these products. Young et al. (2010) mention that for this reason, the difficulty of accessibility of products negatively affects the intentions of purchasing green products as an obstacle. On the other hand, it is explained that the presence of widely distributed green products positively affects the easy purchase period because it reduces the time consumers spend searching for stores. According to Moser (2015), even the locations of green products

both in-store and on online platforms have a positive effect on consumers' intentions to purchase. In addition, distribution strategies should be considered in terms of environmentally friendly approaches. Necessary measures should be taken to use less energy and sales points should be planned in places that are accessible according to consumer time and energy savings. According to Yüksel (2002), the development of both new recycling channels and new distribution areas will be possible with the increase of more environmentally friendly markets.

5.8. Consumer Innovativeness

The increasing demand for new and different products and brands explains the concept of consumer innovativeness to break away from past habits and preferences. Since consumers' desires for different and brand-new purchases or experiences indicate consumer innovativeness, it is understood that such consumers mostly buy products faster and earlier than other consumers. According to Bülbül and Özoğlu (2014), it is stated that consumers who use such innovative products give feedback to other consumers about new products and are effective in purchasing and promotion sections. According to Hirschman (1980), innovative consumers are examined in three parts adopters, users, and indirect innovators. While users are defined as those who make discoveries in the new usage areas of existing products, indirect innovators are shown as those who try to get information about new products, and adopters are shown as those who accept the relevant products in person. It is revealed by the research that the intentions of purchasing green products and the effects of innovation on marketing strategies. Bülbül and Özoğlu (2014) mention that strategies developed for the promotion of green products are likely to affect the possibility of innovative consumers accepting and owning green products. They also state that the use of the environmental sustainability factor in marketing approaches that emphasize the environmental impacts of products can increase the possibility of innovative consumers purchasing green products.

5.9. Environmental Attitude

According to Akdoğan (2021), environmental attitude is explained as the sum of people's ideas, feelings, and intentions to take action related to environmental activities or environmental issues. In this sense, it is suggested that environmental attitude has significant effects on people's green product purchasing tendencies and behaviors, closely interacting with different elements such as environmental sensitivity, environmental awareness, environmental responsibility, and natural values. According to

Barış and Odabaşı (2012), it is explained that for consumers to attribute a positive meaning to any product, the evaluation of the benefits related to the product and this positive perspective method will be effective in purchasing decisions. As a result of the research conducted by Urien and Kilbourne (2011), it is explained that consumers' individual development and production values directly affect environmentally sensitive consumption movements and environmentally friendly goals. As a result of the research conducted by Omar et al. (2015), it is stated that environmental attitudes directly affect consumers' purchasing of products that do not harm the environment or recycling activities.

6. Perceived Environmental Responsibility Consumer Activity

Whether individuals have environmental responsibility can be understood according to their actions that damage the ecosystem or can harm the environment. Individuals' thoughts and ethical approaches towards the environment are directly related to their environmental responsibilities. According to Nguyen et al. (2015), individuals with a high level of perceived environmental responsibility are more likely to exhibit behaviors that can affect the elimination of environmental damage. Based on the relevant research, it is mentioned that the effects of environmental responsibility perception on consumers' preference for more environmentally friendly products are effective enough to affect individual behaviors. According to Lee (2008), it is stated that as individuals' feelings about their environmental responsibilities strengthen, their likelihood of preferring and purchasing green products also increases.

The beliefs that consumers think can be effective in seeking solutions to social problems are shown as perceived consumer activity. According to Leblebici (2008), it is stated that those with a high level of environmentally sensitive behavior exhibit such behaviors because they believe that they can achieve positive results as a result of their behaviors. Straughan and Roberts (1999), who explain perceived consumer effectiveness in the form of individuals' attitudes towards their ability to individually contribute positively to environmental problems, state that there is a positive interaction between defined and perceived consumer behaviors and environmentally sensitive consumer behaviors. Tanrıkulu (2014), on the other hand, states that in the totality of the studies conducted, consumers' perceptions that their efforts can be effective must be strengthened for their environmental concerns to be transformed into concrete actions.

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CHAPTER 5

GREEN AVIATION: INNOVATIVE APPROACHES AND STRATEGIES FOR SUSTAINABLE AIR TRANSPORTATION

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Abstract

The concept of green aviation, which has found its place in the modern world and human life, focuses on minimizing the environmental impacts of the aviation industry with innovative technologies and operational strategies of alternative fuel search. This study, which addresses innovative methods and approaches for sustainable air transportation, examines sustainable aviation fuel (SAF), hydrogen propulsion, electric aircraft, advanced air traffic management, and ruby-saving operational activities by considering past applications in the world. In addition, it emphasizes the existence of infrastructural difficulties by examining the consortia established for environmental protection purposes in the world for the aviation sector from a managerial perspective. In this study, where the theoretical framework is examined in detail, it is concluded that a greener and more sustainable workflow can be achieved in the aviation sector with the holistic processing of technology, policy, and efficiency measures. Another prediction obtained from the research is the contribution of market-based measures and subsidies

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to the sustainable aviation transformation in the same way to reduce carbon emissions with global regulations. As a result, it is emphasized in this study that multi-stakeholder collaborations and innovative solutions are of critical importance for the future of green and sustainable aviation.

Keywords: Green Aviation, Aviation Management, Sustainability, Air Transportation.

1. Introduction

Popowich et al. (2020) mention that many studies have investigated the negative aspects of human activities and actions in the environment, especially in the last 40 years. Prillwitz and Barr (2011) explain that the most well-known negative effects resulting from human activities are water, noise, and air pollution, as well as affecting natural resources and causing environmental problems. On the other hand, when the ecological performance of employees, which is mandatory for the sustainability of organizations, is taken into account, it should be considered natural that this situation has become the main concern in relatively developing or developed countries. For this reason, high-level officials and those in regulatory positions encourage organizations to use green products and services in response to this situation (Comin et al., 2020; Hameed et al., 2020; Cop et al., 2020; Yong et al., 2020). Moreover, governments in many developing and developed countries are changing their strategic and political plans to protect natural resources, reduce greenhouse gas emissions, and control industrial pollution. As a result, organizations are trying to create an environment that supports activities that will abandon their traditional methods and transform them into green models to achieve better environmental performance.

According to Norton et al. (2014), the environmental work environment of an organization shows the extent to which employees' perceptions of the institutional practices, policies, and culture are related to environmental responsibility. Employees' perceptions of organizational work areas show individual value-centered tables, accepted values , and behavioral norms that aim to explain their knowledge in the places they work. Therefore, employees' perceptions of a green climate allow them to interpret organizational strategies and activities by recognizing them in terms of green philosophy and environmentalism. Green climate in organizations is seen as a contextual factor that regulates employees' environmentally-centered actions by giving guidelines and targets regarding the results demanded from them as a collective factor. According to Zhang and Liu (2016), employees' green behavior, as a concept consisting of the definition of pro-environmental

behavior, is one of the most important activities in achieving real results in the strategic sustainability policies of a company.

The phenomenon of climate change attracts a lot of attention due to the rapid growth of the aviation sector and its negative effects on the earth and living things. When the effects of the number of passengers and cargo carried and the amount of fuel used are taken into account, air transportation has become very impressive worldwide. The importance of fuel consumption has increased in the same proportion as the growth of the sector from the ‘80s to the present. When the increasing amounts of fuel are taken into account, the environmental effects of the emissions created also impose responsibilities on the civil aviation sector as in every sector. The increase in civil aviation, increasing air traffic, increasing fuel costs, and ground handling operations with increased efficiency in return for more careful environmental targets are the basic elements of sustainability in air transportation. According to Weiszer et al. (2015), the planning of the runways used in this complex structure, the organization of ground movements, and the provision of ground handling services constitute important parts. Global air traffic continues to grow steadily in general. However, the travel restrictions imposed due to the COVID-19 pandemic have almost brought passenger air transportation to a standstill.

Abdullah et al.. (2016) listed the Green Airline Rating System and related success factors based on three main criteria for air transportation to reach targeted points.

Daily Operational Activities: According to Wu (2008), the relevant activities consist of crew, cargo, baggage, food services, passenger services, fuel supply, cabin cleaning, and other routinely controlled technical work. There are some sub-factors within daily operational activities. The most important of these is the fuel management program. According to Ryerson et al. (2015), all airlines that pay attention to green management choose to load only enough fuel to reach their destinations to reduce air pollution caused by their flights and to reduce the transportation costs of excess fuel put into the aircraft. According to Stroup and Wollmer (1992), by using the correctly calculated amount of fuel in the aircraft, it is possible to reduce costs by up to 6% in medium and short-term flights and even to reduce this figure by up to 8%. To implement this, the time required to determine the arrival between flight points at certain periods within the framework of the rules set by Air Traffic Management (ATM) must be arranged according to optimum flight requirements (ICAO, 2012). The types of fuel used in fuel management programs are also being changed, and studies in line with environmental

policies continue to be carried out. According to the research of Kousoulidou and Lonza (2016), it is stated that sustainable fuels can be mixed with fuels called HEPA, which are composed of renewable or non-renewable vegetable oils, even if they are obtained with different inputs. According to IATA (2012), Air France and KLM, which are important companies in the sector, have carried out flights using aircraft fuels obtained from these oils.

Another factor stated for daily operational activities is the reduction of the weight of aircraft. According to OECD (2012), reducing the weight of aircraft is possible with the creation of new aircraft designs and continuous development. According to Holzwarth (1998), Boeing and Northrop, which previously manufactured under the name of McDonnell Douglas and currently manufacture aircraft worldwide, began manufacturing from lighter materials under the name of Advanced Lightweight Aircraft Body Structures Program in the early 1990s. An example of the developments made in the aircraft is the reduction of the weight of passenger seats and technical equipment in the entire aircraft cabin under the name of the "Cabin Conversion Plan". According to Tsai et al. (2014), this development work is carried out by the ICAO's recommendation that 'passengers should be able to evacuate the aircraft within 1 minute when necessary. Thanks to these developments, Boeing has achieved savings of approximately 12% by reducing the weight of its aircraft by 20%, according to Zu et al. (2018). Similarly, Airbus achieved a 30% saving in the A320 model, while it achieved a 20% fuel saving in the A321 model, adding an average of 900 km more range to its normal range (Airbus, 2021).

Flight planning is another factor shown among organizational activities. Air transport companies need to do some work to fulfill their obligations to the environment. In this section, flight planning, which is done to determine the flight altitudes and speeds of the aircraft in the departure and arrival directions, is shown among the important elements in reducing environmental impacts as well as in the areas of safety and cost. One of the ways to carry out these studies is the flight optimization algorithm. According to Murrieta-Mendoza et al. (2016), this calculation determines the best route for flights by adding weather data and provides fuel savings, as well as providing great benefits in reducing environmental pollution by reducing costs. In the study conducted by Tian et al. (2020) as a simulation, comparisons were made on 4 different models of a flight from Frankfurt to Barcelona. The results showed that different trajectories have different costs, flight times, and flight distances, and they revealed that savings can be achieved with a 1% decrease in the route related to flight planning and the correct calculation of distances.

2. Eco-Friendly Air Transport

Cabin Cleaning, or greening on board, is among the elements that should be taken into consideration for environmentally friendly flights, and it is stated as consumption-based cabin waste. According to Li et al. (2003), cabin waste includes food, cleaning, and kitchen waste, excluding products carried by passengers to the aircraft. For their in-flight analysis, 14 products were selected from each short, medium, and long-haul flights, and analyses were made for the resulting waste. According to IATA (2019), it is thought that the damage caused by the relevant waste to the civil aviation sector is 927 million dollars. Airlines are making the necessary arrangements both to recycle these wastes and to reduce waste production rates. In 2020, Turkish Airlines included more than 1000 tons of waste in the recycling process, 69 tons of which were packaging-based.

For environmentally friendly flights, ground services are another element that should be taken into consideration. According to Weiszer et al. (2015), one of the key points of sustainable air transportation is ground services. The relevant services include the movements of aircraft before and after the flight, baggage preparation, loading, ground support equipment, these solution studies, personnel training, runway planning, and other general ground services. Ground services at airports carry out supporting studies for the use of environmentally friendly vehicles, as they are an important factor in the increase in emission values and releases (Aerospace, 2012). According to Soltani et al. (2020), the fuel consumption of aircraft in the possible 15-minute period on the taxiway before the flight corresponds to 7% and is equivalent to the total fuel consumption of 1600 cars on average. For this reason, it is recommended to use tractors operating on electric energy instead of fossil fuels. Accordingly, the Lufthansa ground handling company at Frankfurt Airport saves approximately 2700 tons of fuel from flights made by using tow trucks called TaxiBot (IAI, 2015).

Corporate Environmental Management Practices: Organizations are expected to be more sensitive to their environment as a result of the pressures they receive from both their internal and external environments. According to Abdullah et al. (2016), great importance should be given to corporate environmental management practices consisting of corporate social responsibility, continuous improvement, and environmental management systems, including ISO 14001 certification, which consist of legal, economic, ethical, and voluntary demands. In this sense, corporate social responsibility and environmental management systems are two of the newest practices that should be paid attention to. Corporate social responsibility has transitioned

from an idea to practice by defining the roles of many different organizations in society. This practice has resulted in organizations behaving within the framework of certain ethical and social standards by transitioning from the fact that it is only right to do to doing what is right, according to Lindgreen and Swaen (2010). According to Hoffman (2001), corporate environmental management focuses on businesses taking strategic measures and making plans to solve environmental issues through institutional understandings of environmental problems. Cowper-Smith and De Grosbois (2011) conducted a study on 14 airlines. As a result of the study, it was determined that 13 airlines worked towards waste reduction and recycling, 12 airlines set a goal to reduce water and energy consumption, 4 airlines took initiatives to support ecological diversity, and 11 airlines aimed at environmental protection projects. As a result, it was understood that airlines initiated studies on afforestation, financing education, and endangered species.

b. Corporate Policies and Strategic Planning: According to Itani et al. (2014), air transportation has both a cyclical structure and a nature affected by the macro environment. For this reason, attention should be paid to the systematic and synergistic nature of the factors mentioned in the preparation of the policies and strategic plans of airline companies. It should be considered that the future will be based on the protection of nature according to international regulations, not only in the civil aviation sector but also in other sectors. The issue of renewing the fleets used by airline companies is both costly and risky due to the severity of its consequences. According to Karagülle (2012), company managers should take into account performance, competition, costs, possible changes that may occur in the future, and environmental impacts when making decisions. In fact, according to Scheelhaase (2010), the LTO cycle process should be taken into account in this regard. According to this concept, known as the landing and take-off cycle, the aircraft types that emit the most CO2 into nature in the report prepared by Statista (2020) are the Boeing 737 series and the Airbus A320 and 321 models. It should be taken into account in the studies that these planes are the most used plane models in the world. The reason for their high emission rates to the environment may also be that they are the most preferred models compared to other types of planes. The correct thought is that newer, more modern, and technological planes both pollute the environment less and are more efficient in terms of performance. Therefore, these factors should be taken into account in the fleet renewal decisions of airline companies. Based on the continuous increase in the use of new planes, Amizadeh et al. (2016) reported that the fleet-based research they conducted on 6 countries affiliated

to the European Union revealed that carbon dioxide emission rates decreased by approximately 1.2% annually between 2010 and 2013.

Commuting program options are shown as another success factor based on the rating system. In fact, in this area, which is dependent on healthy transportation options, the results are examined as a result of easing the necessity for employees to commute to their jobs. As a result of the research conducted by Abdullah et al. (2016), it is explained that with this option, employees can use public transportation or car sharing to go to their workplaces or use the remote working option by focusing on reducing carbon emissions. In their research examining the widespread use of remote working due to the effects of Covid-19, Sutton-Parker (2021) revealed that due to this reason, emissions due to commuting decreased by 97% in 2020 compared to other years. In another study, Jack and Glover (2021) stated that the use of remote working systems in business trips within the European Union can be applied by 30%, and this will result in a saving of 35 million tons of carbon dioxide. The liability limits of the civil aviation sector also include the environmental impacts of emissions as a result of air traffic, fuel amounts, and costs, which are increasing day by day. Meeting the demand for air transportation, making the international air transportation structure more efficient, and reducing emission rates should be constantly taken into consideration as they will affect the internal and external environment of the aviation sector. Therefore, it should not be forgotten that success criteria and global efforts based on the main criteria will be effective in achieving the determined environmental targets.

3. Sustainability

Although it is a new concept, sustainability means continuing an existing situation or thing, maintaining its functioning as it is. The concept of sustainability, which has been a subject of much debate in recent years, is an area that has been examined in great detail in many disciplines (Ergün and Çobanoğlu, 2012; Kaypak, 2012; Şen et al., 2018). The main reason why this concept has been used so intensively until today is that it is completely affected by human-related activities. Human behavior and activities can change all the functioning in the world. Climate change, which is defined by scientists as climate change or global warming, describes the disruptions in the natural functioning of the world caused by human activities. According to Can (2019: 139), climate change is explained as changes in the climate that occur in wider geographies and at wider times and that should be investigated by taking into account meteorological or atmospheric changes

and deviations. To have a more livable world, the resources at hand should be used as much as needed. Here, the concept of sustainability means using the available resources in a controlled and limited manner and making them productive in a way that can be recycled as a result of use. For this reason, it is seen that all organizations operating in the fields of today's trade, industry, food, and tourism have started to pay attention to the concept of sustainability and continue their activities accordingly. One of these sectors is the civil aviation sector, which has activities based on transportation. Sustainable aviation is mentioned as a long-term approach that aims to shape the future of the civil aviation sector in a quiet, clean, and smart direction.

In fact, in addition to ensuring the continuation of production and diversity, ensuring the sustainability of human life is seen as the most fundamental equivalent of sustainability. Accordingly, the strongest meaning is that individuals act without endangering the needs of future generations while meeting their personal needs. Therefore, the sustainability of a phenomenon, behavior, or anything depends on maintaining its current position and leaving an environment with sustainable ecological, economic, and social conditions for future generations. According to Becker (1997: 16), the literal meaning is explained as the ability to create efficiency against obstacles. Initially, with the damage to natural areas and the perception of differences in nature, the concept of sustainability has begun to be examined as a much more frequently used word in the context of climate values and has started to be constantly included in current issues to create efficiency. According to Kuter and Ünal (2009: 146), the concept of sustainability, which has reflections in many areas such as banking, technology, agriculture, and tourism, has ultimately benefited the studies in this field to be taken into consideration. The rate of increase in the human population leads to negative situations such as the increased use of limited natural resources and the failure to fully meet the needs day by day. In contrast, all studies have revealed that individuals should be more planned and careful in spending resources. In addition, disruptions in the world's ecosystem have also revealed global climate problems. Therefore, the issue of how the basic resources at hand should be used has begun to gain importance. In addition to the fact that individuals must personally do their part, all studies carried out at a more institutional level in this area should also be actively included in the process. According to Kuşat (2012: 227), one of the necessary prerequisites is for the social, environmental, and economic systems to work within similar objectives as a result of establishing sustainability.

For economic progress to be fully achieved, the natural resources in the world should also be used or spent in a similarly controlled manner. People's

awareness in this area should be increased, and all applications that need to be carried out accordingly should be put into action. According to Müller (1996: 177), the point that needs to be taken into consideration is that the people who will continue their activities in the future should improve their living conditions in the best way and increase their quality of life. To fully experience sustainability, its importance should be well understood at the company level, and in addition to being included in financial reports, awareness should also be provided in terms of society, the environment, and individuals. In today's organizations, sustainability should be used not only in financial statements and reports but also in business strategies, corporate values , and operational processes. In all organizations that are trying to keep up with the times and developments, the sustainability approach is now the main factor in political and strategic decision-making processes, supply chain operations, and product development periods.

4. Sustainable Aviation Concept

Sustainability in the aviation sector is a long-term strategy aimed at solving the problem of creating a future where the relevant industry uses quieter, cleaner, and smarter systems. The turning points in the transition to sustainability in the aviation sector are; airplanes that cause global warming due to CO2 emissions, preventing climate change, reducing greenhouse gas emission rates, improving air quality, reducing noise pollution, protecting natural resources, proper waste management practices, developing environmentally friendly energy sources, utilizing renewable energy sources, using friendlier technologies and using sustainable fuels.

To reduce possible contributions to global emissions, concrete targets have been determined, and different studies have been initiated accordingly. With the development of sustainable aviation fuels, more innovations are coming to the fore in the fields of technology and aircraft design used to minimize environmental impact. Apart from this, attempts to balance and reduce carbon rates are another important focal point. In addition, operational and infrastructure improvements are also of great importance to reach the targeted sustainable points. Increasing energy efficiency at airports, optimizing waste management, and using renewable energy sources more effectively are also important in terms of sustainability practices. To implement all these practices, it can be seen that sector stakeholders are turning to green and sustainable financing alternatives in financial terms. Supporting environmentally sensitive investments and accepting sustainable aviation practices are also made easier. In this section, various awareness

activities, such as training programs, seminars, reports, and conferences, are also carried out for all stakeholders in the sector to raise awareness. According to Jagroop et al. (2022), they discussed the roles and effects of different decision levels, such as strategic and operational parts, in ensuring sustainability in the civil aviation sector. As a result of their research, it was understood that decisions taken at the tactical level have the most impact on reducing fuel consumption used in aviation. As a result of the research, it is stated that operational level decisions come second and strategic level decisions come third. In the relevant study, it is explained that mid-level stakeholders, such as aircraft manufacturers and airlines, have critical effects on the sustainable growth of the aviation industry. However, it is also explained that the relevant stakeholders need to be connected at both strategic and operational levels, and they need to be empowered to be mobilized.

In another study, Dimitroulis and Karagkouni (2022) evaluated airport strategic plans and environmental reports in their framework presentations to support the sustainability level in the civil aviation sector. In their studies, where the interaction between business performance and sustainability at airports was examined, comparative analyses of the limit values determined by airports and regulatory administrators were made by considering environmental factors such as noise, emissions, water, and waste. In another study, Trivedi et al. (2023) aimed to understand and discover the measures taken in sustainability practices in the civil aviation sector. As a result of the study, it was stated that the sector was growing rapidly, but on the other hand, sustainability information and awareness were lacking, and it was mentioned that the value given to development, economic and environmental efficiency was of great importance in sustainability indicators. In the study conducted by Markatos and Pantelikis (2023), aircraft were compared by considering the ecological, technological, cyclical, and economic sustainability criteria in the civil aviation sector. As a result of the study, it was stated that data deficiencies regarding aircraft constituted a problem and that this deficiency could be eliminated in future studies. In another similar study, Sankar et al. (2023) examined the challenges, problems, and best practices of sustainability practices in the Indian civil aviation industry in the global aviation sector. As a result of the research, it was concluded that a long-term vision should be created where sustainable practices are a priority in the entire civil aviation sector. In another study conducted by Mahama and Iyer (2023) in the field of adoption of circular supply chain practices in the civil aviation sector, it is stated that relevant awareness can be an important factor in reducing waste pollutants such as carbon dioxide and plastic. In addition, the study indicates that stakeholders need to make some changes in their practices to achieve

sustainability goals and shows that corporate social responsibility will play an important role at this stage.

In another study conducted on the subject in civil aviation, Bouwer (2023) focused on the sustainable development of air transportation in terms of emission and noise reduction. The research discusses the obstacles to the implementation of green solutions in air transportation, such as the adoption of aviation fuels, the transition to green airports and technology transfers, and the difficulties in reducing them. In the study conducted by Orhan (2021), it is stated that airline strategies supported by liberalization policies contradict the environmental sustainability of civil air transportation, while the increase in aircraft take-off and emission values has a high impact on environmental pollution. In their study, Asker and Kiracı (2022) analyzed the financial statements of the top 20 global airline companies operating globally in the last 10 years and tried to determine their sustainable financial performance. As a result of the study, they provided insights into the financial performance of airlines in the air transportation industry and contributed to the literature by creating a different perspective on sustainability. In a similar study, Kim and Son (2021) compared the environmental efficiency of global airlines in different continents by using data from a certain period in recent years. As a result of the study, it is stated that airline companies in Russia and Europe are the companies with the highest environmental efficiency, while airline companies in Canada and North America are in second place, and Latin America, the Middle East, and Africa have lower levels of environmental efficiency. As a result, it is recommended that all airline companies develop ecological management practices that will be most efficient according to their geography.

5. Green Aviation Approaches and Strategies in Sustainable Air Transportation

Many airlines around the world attach great importance to both green behavior and environmental sustainability due to today's conditions. In addition to using Sustainable Aviation Fuels, SAF to reduce carbon emission consumption, such businesses are developing strategies that increase operational efficiency by increasing their investments in more efficient engine technologies and aircraft and are turning to renewable energy sources as a transition. In addition to these, they are participating in various international standards and regulations and signing important agreements. The reason for participating in and signing such agreements today is the variety and amount of waste that has changed over the years. The civil aviation sector generated

more than 900 million metric tons of CO2 emissions in 2019, the beginning of the COVID-19 pandemic. When looked at in terms of comparison, it can be understood that this figure makes a big difference compared to the 2004 figures of 627 million metric tons of emissions (FAA, 2023). According to the figures of the International Energy Agency (IEA), it is understood that for the civil aviation industry to achieve the net zero emission target by 2050 specified in the strategic planning, it is necessary to develop alternative fuels to Jet A1 fuel in traditional use with the use of Sustainable Aviation Fuels (SAF) (IEA, 2019). Waste management is a factor that is at least as important as carbon emissions. The production of certain types of waste during civil aviation operations and the acceptable management of these wastes play an important role in terms of both legal and environmental responsibilities. According to Atkin et al. (2006), the civil aviation industry causes an average of 9000 tons of plastic waste every year. This figure means the consumption of enough aluminum cans to build 58 Boeing 747s or enough magazines and newspapers to cover a football field with a depth of 230 feet. Therefore, since it is seen that such large amounts of carbon emissions and waste increase the environmental impact of the relevant industry, efforts in this regard should be increased. When the data of airline companies known as pioneers in the civil aviation sector is examined, it is seen that they have recently paid more attention to green behavior and sustainability issues.

For example, according to the sustainability reports published by Turkish Airlines, it is understood that steps were taken to increase both the environmental management awareness and professional competencies of their employees in 2022. It is reported that a total of 6263 hours of training was given to 8350 organization employees in this regard, and 56 hours of environmental training per person was given to 75 contractor company employees (THY, 2022). In addition, 13,227 people participated in corporate sustainability training, which also included information on environmental, social, and governance areas, and 4409 person-hours of training were received. Again, based on the relevant reports, Turkish Airlines provided greenhouse gas awareness training to 3586 people in 2022. In addition to these trainings, 358,345 m3 of wastewater from the flight operations of the relevant company was discharged using wastewater channels.

Another global airline company, Emirates Airlines, has prepared special programs to recycle both in-flight entertainment systems and cabin equipment (IEA, 2019). In this way, it benefits from new programs in recycling old electronic devices on its aircraft. Lufthansa Airlines has also reduced water consumption by using special systems in the toilets on its aircraft (FAA, 2023). It is known that some different airline companies have developed

innovative solutions to reduce company-wide water use. According to the report, Heathrow Airport has made an exemplary study compared to other airports in terms of waste management and can recycle 70% of the waste generated. In this waste management, all paper products used at the airport are also made from recycled materials, which is another good practice.

To increase the use of Sustainable Aviation Fuels (SAF), the United States is also working on an application called the "SAF Grand Challenge". This application aims to increase the relevant SAF usage to 3 billion gallons per year by 2030 and to the entire jet fuel demand by 2050. Of course, since this application cannot be done by a single institution, support is also received from the Ministry of Agriculture and the Ministry of Energy for cooperation to achieve the relevant targets (FAA, 2023). It is possible to see similar plans in other countries. In the United Arab Emirates, a general policy for SAF has been developed, and the target is to produce 700 million liters of SAF per year by 2031. The relevant policy was created within the framework of the United Arab Emirates' net-zero carbon emission and energy strategy by 2050. There is a voluntary target for national airlines affiliated with their own countries to meet 1% of their fuel usage with locally produced SAF by 2031 (UAE Government, 2024). Canada, on the other hand, has started to implement sustainability in the field of green propulsion technologies, the development of efficient aircraft systems, and alternative fuels under the name of "Aviation Technology Initiative" (INSAT). It is stated that the Canadian Government has invested 350 million dollars in this sustainable aviation innovation system to strengthen the civil aviation sector and provide economic comfort (INSAT, 2024). It is also stated that Japan actively supports and follows the development of both SAF fuels and other sustainable aviation technologies to adhere to the net-zero carbon emission targets of the International Civil Aviation Organization (ICAO) by 2050. It is even stated that they are collaborating with Boeing and other international partners to advance these developments (ICF, 2023). As a result of all these examples, when the policies, strategies, and collaborations of airline companies and some countries are taken into consideration, it can be said that they are investing in cleaner fuels, innovative technologies and supporting strategies, and this is a global stance towards making the civil aviation sector more sustainable.

Another important actor in the civil aviation sector, especially in the context of green aviation, is airports. While airports provide opportunities for the acceleration of international trade, they also provide benefits to important parts of the tourism sector and play critical roles in the growth of today's economy by strengthening global transportation networks (ACI,

2024). The contribution of airports to the growth of national economies increases in proportion to the increase in the number of flights they carry out. However, it should be expected that these increases will cause environmental problems. According to ACI Europe (2015: 8) reports, these environmental problems are stated as carbon emissions during takeoff and landing, noise pollution, high energy consumption, and pollution caused by wastewater and solid waste.

Areas that consume high amounts of energy are terminal buildings, security systems, lighting systems, and other infrastructure elements at airports. In this section, measures for energy efficiency are of critical importance in reducing consumption. According to Demirci et al. (2023), the use of renewable energy sources has the potential to reduce energy consumption. It is known that planes landing or taking off emit significant amounts of carbon dioxide and other greenhouse gases during these activities and that these emissions have negative effects on climate change. Different practices are being implemented to reduce these harmful emissions and develop various sustainability projects at airports. The noise created by planes during landing and takeoff also has negative effects on the communities living in their surroundings, and it is seen that this phenomenon, referred to as noise pollution, poses a major problem, especially at airports with high flight density. According to Andreopoulou and Gkantalidou (2023), several measures should be taken to reduce noise levels at airports, and regulations should be followed in this regard. During cargo and passenger operations at airports, large amounts of solid waste are generated. Therefore, the management of these wastes is also a critical area for environmental sustainability. According to Sarbassov et al. (2022), there are different ways of sustainable waste management practices, such as reduction at the source, recycling, and reuse. Waste water is the most fundamental part of sustainable waste management. According to Greer et al. (2020), due to the production of wastewater as a result of various activities at airports, improper management of these causes environmental pollution. Treatment and reuse of wastewater is very important in reducing its environmental impacts.

The management of environmental problems created by airports in achieving their sustainability goals is of great importance. Therefore, they need to benefit from sustainability practices, and the success of these practices may vary from country to country. The concept of green management here is an approach that aims to minimize environmental, social, and economic impacts to meet the needs of both current and future generations. Green aviation ideas are used to develop infrastructures at airports, establish interaction with society, and sustainably manage operational activities.

According to Kalyoncu (2023), within the scope of green management practices at airports, recycling of solid waste, supporting the use of reusable products instead of single-use products, methods for more efficient use and saving of water, use of hybrid or electric vehicles to reduce emissions, preparation of strategic noise maps to control environmental noise and similar programs are used. The types of these program applications are listed below:

5.1. Energy Management

In airports that consider green management, determining and monitoring energy consumption is the most important step of the relevant process. Because energy consumption is relatively high due to the services provided and operations performed at airports. According to the study results of Ortega and Manana (2017), terminal buildings are the areas where the most energy is consumed at airports. The areas where the highest energy is needed in this excess consumption part are ventilation, heating, and lighting. The energy used by vehicles used in ground services, security systems, and air traffic control towers, which are among the most important areas, is also considered important in terms of its rate. In contrast, fossil fuels and electricity are used as energy sources at airports. Another energy source that can be shown as an alternative is renewable energy, according to Akyüz et al. (2018). The need for high amounts of energy and the availability of sufficient space in return make it logical to use renewable energy at airports. Thus, dependency on fossil fuels is reduced, energy security is ensured, and compliance with regulations imposed by international and local authorities can be ensured. According to ICAO (2017) reports, renewable energy systems for green airports are not only economical but also strategic in terms of environment.

Determining renewable energy management within the scope of green aviation at airports varies primarily according to factors such as geographical location, amount of energy required, and existing infrastructure. According to Radomska et al. (2018), all these factors play a role in selecting the most appropriate renewable energy sources in terms of energy efficiency and cost-effectiveness within the scope of green aviation. Among the airports that benefit from renewable energy worldwide, Cochin International Airport in India is a pioneering example with its systems that operate entirely on solar energy. According to Yıldız et al. (2020), Galapagos Airport in Ecuador uses only renewable energy in all its facilities and makes a significant contribution to green aviation goals. Izmir Adnan Menderes Airport in Turkey is shown among the most environmentally friendly airports in Europe by generating electricity through the photovoltaic panels it has installed. Again, according to DHMI (2023) figures, Antalya, Erzincan, and Sivas Airports in Turkey

also generate electricity with the solar energy systems they have installed within the scope of green aviation, reducing electricity costs and contributing to sustainable aviation.

5.2. Solid Waste Applications

According to Cheremisinoff (2003), another activity that contributes to the sustainability efforts of airports is the application of sustainable waste management. Waste batteries, vegetable oils, electronic devices, and fluorescent lamps, which are harmful to both public and environmental health, are collected using special equipment at airports and stored in temporary storage areas. It is explained that these processes provide great benefits as they prevent environmental pollution as well as provide economic benefits. It is also aimed to reduce waste, reuse it through recycling, and convert it into energy, thus contributing to the environment and economy. For example, it is explained that important practices are carried out by setting a zero waste "Zero Waste" target at San Francisco International Airport in the United States. The relevant airport uses reuse strategies by combining organic waste and separating recyclable materials. It is also stated that 80 percent of the waste was recycled in 2021 thanks to these processes. In addition, awareness has been raised in terms of green management by reducing the use of plastics in terminals with innovative policies, such as banning the sale of plastic bottles (San Francisco International Airport, 2021). Another example airport is Changi Airport, which also draws attention with its sustainable-centered projects and waste reduction strategies. The most important feature of the terminal is that food waste is tracked, and information is provided to reduce it, thanks to smart measuring devices used in restaurants. Non-recyclable waste can also be recycled in waste incineration facilities for this purpose. Amsterdam Schiphol Airport in the Netherlands, like other green airports, also adapts to circular economy principles and uses innovative solutions in waste management. 90 percent of the waste caused by demolition and construction periods in terminal buildings is recycled and this waste is used in new projects. Narita Airport in Tokyo, Japan, stands out with its environmentally friendly strategies in waste management. In the terminal building of the airport, systems are used to separate and recycle plastic and paper waste and to convert food waste into biogas. Heathrow Airport in London, the capital of the United Kingdom, also uses comprehensive separation systems to organize the regular transfer of waste to landfills. With the recycling points located in the terminal, passengers can separate materials such as paper, glass, and plastic, and energy can be produced by converting food waste into biogas. According to Sreenath et al. (2021),

cyclical economic principles such as energy, compost, and biogas production from organic waste generated in Asean airports are adopted. In this way, both environmental impact is reduced and economic value is created. Waste management policies are also used within the scope of sustainable and green aviation at Istanbul Airport in Turkey, and recycling collection rates have been increased with recycling collection practices such as separating waste at the source and collecting it separately according to their types. In addition, awareness was raised, especially on waste management issues, with training programs for passengers and personnel, and as a result, a zero-waste certificate was obtained. According to Kalyoncu (2023), with these methods used, the amount of waste at the airport was reduced, and the green airport application was fully met by increasing recycling rates.

5.3. Water and Wastewater Management Practices

Just like in large-scale industries and factories, water requirements are also high at airports. In addition to passenger water consumption at airports, water is needed for meeting the basic needs of personnel, cleaning equipment, landscaping around the airport, maintenance of green areas, cooking, beverage outlets, and activities of airline catering companies. According to Sreenath et al. (2021), it is estimated that water consumption will increase in cases where construction works and passenger traffic increases at airports.

It should not be forgotten that wastewater management also brings important responsibilities for airports. The main source of wastewater generated at airports consists of water usage related to aircraft maintenance, ground services used, washing of aircraft, and airport maintenance. According to Liao et al. (2021), the quality of water used at airports can decrease due to oil and fuel leaks, cleaning of solid wastes, and de-icing operations. Especially in the winter season, when the use of chemical-based liquids is mandatory to clean the snow at airports. As a suggestion for this, Koenig and Ryerson (2011) state that infrared deicing systems should be used for deicing operations against the risk of decreasing water quality at the airport. Apart from these, demolition and construction works at airports may also cause pollution of water resources. For this reason, all water discharged here should be meticulously purified in a way that will reduce traces of hydrocarbons, sediments, and heavy metals. Even rainwater collected at airports where chemicals are used in deicing operations needs to be purified. According to Thomas and Hooper (2013), to implement sustainable water management and green aviation rules at an airport, there should be a systematic approach, and the most effective way to do this economically and environmentally is to implement this at the source. Recommendations include, first of all,

raising awareness and encouraging the implementation of programs called "closure", using automatic closure and collection systems based on human forgetfulness, using sand instead of water and detergent for issues such as fuel spillage, using low-consumption brooms and similar equipment.

In addition, to develop water conservation programs at airports, the rates in the usage areas must be continuously and meticulously monitored. In these monitoring sections, automation systems, smart meters, and digital data-based systems are used to determine water consumption habits and facilitate the understanding of saving opportunities. Significant savings can be achieved in water consumption with automatic sensors, pressure-controlled spray systems, motion sensors, and low-flow fixtures. According to De Castro Carvalho et al. (2013), it is suggested that airports can make constructive contributions to the water management objectives, which are increasingly important on a global scale, by utilizing long-term water management plans, determination of priority targets, performance measurements, continuous improvement, and reporting cycles.

It is stated that the use of the TWS system in water usage at Hong Kong International Airport has reduced drinking water demands by 52 percent. According to Leung et al. (2012), there is a mixture of three types of water in a specified TWS system: sea water, recycled grey water, and fresh water. According to Baxter (2022), a comprehensive water policy is implemented at the relevant airport to reduce water consumption, support reuse, and bring discharged wastewater to environmentally harmless levels. One of the airports that can be an example of water and wastewater management at airports located in more arid regions is Mildura Airport in Australia. One of the most important strategies implemented by this airport is the collection, storage, and reuse of rainwater in areas that need maintenance, such as the irrigation of runways and surrounding green areas. In this way, both the pressure on limited water resources is reduced and water usage costs can be reduced. Graywater treatment facilities established or proposed at airports to reduce environmental impacts also allow the reuse of treated water in runway cleaning, garden irrigation, and some technological equipment. According to Somerville et al.. (2015), this approach also provides economic gains by providing high-cost advantages in addition to environmental gains. Water management in the field of sustainable and green aviation cannot be limited to technical solutions only. The participation of airport managers, relevant state authorities, water suppliers, and the local community is also needed. In this way, it will be possible to meet the demands of different interest groups and create a more economically feasible, socially accepted, and environmentally sensitive water management plan.

5.4. Use of Technological Innovations

Rapidly increasing passenger demands and rising safety standards, today's civil aviation sector is faced with risks stemming from climate change and sustainability-centered expectations. According to Halpern et al. (2021), airport operators are also turning to more digital technologies to carry out processes in a more effective, environmentally friendly, and flexible manner under these conditions. In the context of green aviation, digital airport transformation provides significant improvements in more problem-free check-in, baggage transactions, and general operational processes. Accordingly, it offers passengers a problem-free operation from check-in to boarding with shorter waiting periods. It should not be forgotten that the passenger-centered way of thinking is the main determinant of the transformation in airports. One of the most important features of places called green airports, which are a type of smart airport, is that the information obtained by a large number of cameras, sensors, weather stations, terminal interior and exterior monitoring points is processed and included in the processes thanks to big data analytics. According to Halpern et al. (2021), prior knowledge analysis techniques, such as artificial intelligence and machine learning, are also used in operational planning, maintenance and repair, and air traffic management, increasing efficiency. Thanks to internet-based devices, smart sensor networks can continuously monitor the entire physical infrastructure at airports from terminals to the farthest points of runways. According to Baxter (2022), these devices can also continuously monitor and control aircraft parking positions, refueling processes, water resource usage, and passenger movements. All stakeholders at the airport, such as airline companies, ground handling companies, and security units, can also make instant sharing using cloud-based platforms. Thanks to all these systems, operational processes become more flexible, and resource management becomes more efficient. In addition, digitalization is effective not only in the transformation of airports but also in passenger experience sections, and consumer satisfaction increases as passenger transactions are accelerated thanks to technologies such as check-in in kiosk systems, mobile applications, biometric security passes, and facial recognition. According to Halpern et al. (2021), thanks to these systems, baggage transactions are also facilitated with real-time flight information and routing services, while accessibility and transparency are created in information flows. Within the scope of sustainability and green aviation at airports, applications that optimize the use of energy, water, and other natural resources are used. According to Baxter (2022), sensors, automation systems, and data analytics solutions are used to reduce water consumption, make rainwater management

effective, and re-include wastewater in the process. In this way, both costs are reduced, and environmental responsibilities are fulfilled by reducing the airport's carbon footprint. Thanks to digitalization and IoT-based network technologies, paper waste is prevented in airport operations and advantages are gained in reducing environmental waste and pollutants.

5.5. Accessibility Practices and Transportation

Budd and Ison (2019) state that rapid urbanization, increasing air traffic, and climate change create pressure for transformation in the transportation and accessibility sections of airports. Especially in the context of sustainability and green aviation, it is imperative to develop advanced applications in the areas of integration and accessibility of transportation. In smart airports where green aviation will be implemented, energy efficiency, renewable resource use, reduction of environmental impacts, digitalization, and general access solutions for all customers should be solved on the same ground. In this sense, one of the main elements of smart airports is to be integrated with the city center or other vehicles such as railways, buses, metro and taxis. To support low carbon emission targets, many large airports in Europe aim to reduce the environmental impacts of road transportation by providing easier access to public transportation and turning to infrastructures such as electric vehicle charging stations and bicycle parking spaces (ACI Europe, 2017). In this way, both the use of private vehicles will be reduced and transportation times will be reduced, thus reducing carbon footprints and making travel more economical. Smart transportation management, as another influencer of green aviation, benefits from technologies such as real-time data sharing, IoT-based sensors, and artificial intelligence-enabled routing systems. The relevant systems support journey planning by collecting a variety of information from road density to weather conditions, from parking availability to public transportation frequency. In this way, effective synchronization can be established in the entire transportation system, and unnecessary waiting and delays can be prevented. Accessibility at airports also plays an important role in green aviation applications. In particular, providing a smooth operation within the airport for elderly, disabled, mobility-impaired, and child passengers becomes a priority. In this sense, it is important to design safe passage points from the very beginning with the support of mobile applications and digital platforms, instant information, visual and audio guidance, wheelchair accessible elevators, touch maps, and special assistance services. As a result, such applications are considered not only as a legal obligation but also as a competitive difference that increases brand reputation, consumer satisfaction, and loyalty. Smart airports support

sustainable transportation structures with the integration of renewable energy and energy efficiency resources in their ecosystems. By utilizing solar panels, geothermal energy, building automation systems, LED lighting technology, and high-efficiency heating and cooling structures, not only terminal buildings but also waiting areas of vehicles and other structures are being made to consume less energy. In this way, the overall carbon footprint of airports is reduced, and the types of transportation passengers choose for their travels are indirectly or directly made sustainable.

5.6. Social Interaction and Social Responsibility

Strategies that will support the environmental, economic, and social sustainability goals of airports need to be developed. In this context, social responsibility and social interaction practices stand out as an important part of sustainable development in the context of green aviation. Because airports should also develop strategies and projects aimed at improving the quality of life of the local people in the regions where they operate. In this way, the environmental impacts of airports are balanced and positive, and rapid operation is achieved in terms of social acceptance. Supporting the education of young generations is also a frequently seen strategy as a type of social responsibility for airports. Istanbul Airport in Turkey organizes workshops to instill environmental and aviation awareness in children with its program called “Little Wings”. In this way, awareness is raised at an early age and a good educational investment is made for the future. Integrating sustainable projects in the field of green aviation with the society is an important factor in raising environmental awareness. San Francisco International Airport in the United States aims to reduce negative environmental impacts originating from the airport by organizing joint campaigns with local governments and the public to reduce plastic waste. Because airports also serve as important logistics hubs during times of crisis. Istanbul Ataturk Airport played a critical role in delivering emergency aid supplies to the crisis area during the 2020 earthquake, providing great support to local communities through both employees and volunteers. Some airports also support and promote the local cultures of the region they are located in by organizing social and cultural events. Changi Airport in Singapore supports the integration of local people with the airport through events and exhibitions organized on national holidays (Changi, 2022). For this reason, the mentioned practices support them to be seen not only as structures that provide economic benefits to airports but also as actors that contribute to the environment and society. Increasing social responsibility projects in the context of green aviation and

sustainability will strengthen the perception of the aviation sector and pave the way for it to gain the support of wider audiences in the future.

6. Greenwashing and Civil Aviation

When explaining the concept of green aviation, it is necessary to focus on the definition of greenwashing, which has been frequently discussed in both social and academic fields in recent years. Greenwashing, which has no consensus, is defined in the literature by Delmas and Burbano (2011) as positive communication regarding poor environmental performance, while Lyon and Maxwell (2011) define it as the continuous display of positive information regarding the social and environmental performance of any organization in a manner that will create a highly positive corporate image without fully explaining it with negative information regarding the relevant parts. In another definition, Lyon and Montgomery (2015) explain greenwashing as a kind of umbrella term indicating misleading environmental communication behaviors. As a result, although it has many different definitions, greenwashing, as a concept, basically refers to making incomplete or exaggerated claims regarding environmental sustainability.

There are some difficulties in both understanding and evaluating greenwashing activities. One of the most fundamental difficulties stated is that the motivations underlying the environmental commitments of organizations cannot be clearly distinguished. While some organizations make sincere efforts to reduce their negative impacts on the environment, it is understood that some organizations engage in superficial green activities to attract environmentally conscious customers. In this way, they can maximize their profits while getting rid of the cost burden of green behaviors and pave the way for an unfair competition environment. To make this distinction, factors such as transparency, consistency, and implementation of organizations need to be examined carefully and meticulously. It should also be remembered that the subjective concept of greenwashing, due to its nature, will make the detection process complicated. Personal perceptions may differ significantly, and it is also possible for an individual's sincere efforts regarding sustainability to be evaluated by other individuals as mere marketing efforts. The real subjective part of greenwashing necessitates a general evaluation approach that includes the content of the message, the impact it may have on the consumer, and the context in which it is presented. The question of whether individuals who follow the relevant advertisement or action are likely to be deceived has the most critical effect in determining

greenwashing behaviors. This examination focuses on the potential possibility of being deceived rather than the certainty of being deceived.

The concept of climate change, which has been emphasized more in recent years, is seen as a major problem because it affects human activities and poses an increasing threat to the world. One of the sectors causing this problem is the civil aviation industry. It should be known that despite its very important position in the global sense and its ability to cover long distances in a short time, air transportation has a very significant environmental cost. It should not be forgotten that the abundance of fossil fuels used and the emission at high altitudes are not only the cause of CO2 emissions but also other greenhouse gases and particles. The aviation sector, in contrast to other sectors, is also under intense scrutiny in terms of the results of its environmental effects. Aircraft emissions have effects on the greenhouse effect, which includes components such as carbon dioxide, water vapor, and nitrogen oxides, thus strengthening global warming. In addition, the rapid growth of the aviation industry also increases the environmental footprint effect. It is known that all industries in the world cause carbon emissions. However, the civil aviation sector is held in a much different place due to its high visibility, mandatory use of fossil fuels, and limited alternatives, mostly limited to emission reductions. Therefore, many public and scientific conferences and discussions are areas where the environmental footprint of the aviation sector is emphasized and its effects are discussed. The report titled "Aviation and the Global Atmosphere" published by the Intergovernmental Panel on Climate Change (IPCC) in 1999 stands out as the only report prepared for a specific sector in this field. When commercial aviation activities and their life cycle emissions are taken into consideration, according to Delbecq et al. (2022), it is stated that the airline industry constituted 2.6 percent of global CO2 emissions as of 2018, and its impact on anthropogenic warming was 5.1 percent when comparing 2000 and 2018. All relevant statistics emphasize the significant effects of civil aviation on the world's climate system and the need to take the necessary measures to reduce these effects. For this reason, reducing the environmental footprint of civil aviation in the fight against climate change should be seen not only as a choice but also as a necessity. It is understood that this situation, which is stated as a necessity, also shows the pressure on the aviation industry to reduce its carbon footprint. It is seen that consumers, namely passengers, regulatory organizations, and investors, also expect and demand that airline companies take measures regarding the impacts they may have on the environment.

Studies show that social concerns about environmental impacts are increasing over time. It is understood that these concerns are not simple

and temporary trends but rather reflect a desire for change that is getting stronger and becoming permanent. This situation has also led to a visible paradigm shift in the approaches of airline companies, which are seen as pioneers in civil aviation, to their environmental responsibilities. In response to the desire of airline companies to be more environmentally friendly, there are initiatives such as publishing sustainability reports, starting carbon offset programs, and increasing their work on the use of biofuels. However, when these behaviors towards sustainability are examined closely, it is thought that they are mostly superficial and far from making a meaningful difference. All airline companies aim to reduce their emissions while achieving their goals of increasing their business volume and passenger numbers in their quest for profitability. Airlines that implement misleading marketing strategies to achieve goals that contradict their nature but are shown to be doing so aim to benefit from the increasing demand for environmentally friendly travel. For this reason, inconsistencies may occur in the sustainability reports they prepare, ambiguous statements are formed in the advertisements or slogans they prepare, and claims that cannot be supported by concrete evidence increase. As a result, although the desire for sustainability in the civil aviation sector seems good, the activities that take place do not go beyond a kind of window dressing. It is a priority for organizations in the sector to prioritize accountability and transparency to create true sustainability and green aviation. In return, passengers, stakeholders, and regulators need to take a critical stance when evaluating the environmental claims of airline organizations and demand stricter standards and actions that can be verified.

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CHAPTER 6

ARCHITECTURE AND BIOECONOMY IN AGRICULTURE: A THEORETICAL FRAMEWORK

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Abstract

Nowadays, natural resources are being depleted every day and more raw materials are needed to meet the growing demand for housing and construction with the growing population. At the same time, the escalating production of materials and energy has raised a variety of environmental concerns. The practice of burning, dumping and uncontrolled disposal of agricultural wastes and by-products poses a serious threat to the environment. Agriculture is main source to make a sustainable life-circle for humanbeings. In this circumtances, there are some new methods to be found to solve these problematic situtions. Bioeconomy can be seen as a solution, known has the aim to recyle the resources to gain some products. In this study, agricultural wastes and/or by-products used in the production of building materials are analysed. The results of the studies on the evaluation of these items are promising. Agricultural wastes and by-products can be used as reinforcement

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material in conventional concrete and mortars, in the production of insulation materials, in the production of lightweight concrete and soil-based composites. With the utilisation of wastes in the production of building materials, it is possible to contribute to the reduction of environmental and global problems, to reduce the consumption of natural resources, to contribute to the economy with energy saving and cost efficiency.

Keywords: Agricultural Waste, Agricultural By-Products, Bioeconomy, Building Materials, Sustainability

Introduction

The global population is increasing on a daily basis, thus highlighting the necessity for the development of sustainable building materials in order to meet the demand in the construction sector. In addition to the significant energy consumption inherent to the production of traditional building materials, which play a substantial role in the construction sector, greenhouse gases and carbon dioxide (CO_2) emissions contribute to global warming by 60% (Jannat et al., 2021). It is estimated that approximately 40% of all CO_2 emissions are attributable to the construction and utilisation of buildings (Sangmesh et al., 2023). The production of one metric ton of cement results in the emission of approximately 800 kilograms of CO_2 into the atmosphere (Gudainiyan & Kishore, 2023). Moreover, cement has been found to account for between 5-8% of global CO_2 emissions (Alyami et al., 2023). Consequently, researchers are focusing on the development of alternative materials derived from industrial and agricultural waste and/or by-products, with the aim of reducing environmental issues arising from the construction industry.

The analysis of agricultural waste can be categorised into four groups: namely, crop residues, industrial processing wastes, livestock waste and food waste (Rahimi et al., 2022). Agricultural wastes are defined as undesirable plant or animal substances resulting from agricultural activities (Jannat et al., 2020). The classification of these wastes is as follows: field wastes and processing wastes. Field wastes are composed of leaves, stems, stalks, seeds and materials related to the crops, and are found in agricultural fields after the planting or harvesting of crops. Processing residues are obtained after the processing of crops into valuable resources (Tariq et al., 2023). Examples of such residues include maize cobs, sugarcane bagasse, wheat straw, and rice straw (Rana et al., 2024). Agricultural waste is defined as including harvest wastes as well as manure and other such wastes originating from farms, poultry houses and slaughterhouses, fertilisers run-off from fields,

pesticides found in water, air or soil, salt and silt leached from fields (Priya et al., 2025). Industrial waste is defined as materials that become unusable during the production process in industrial settings such as mills, factories and mines. Examples of such materials include fly ash, bottom ash, metals, glass, slag, sludge and plastic fibres (Jannat et al., 2020). Agricultural and industrial wastes can be used in animal feeding, fertiliser and soil regulation, bioenergy, bioplastic, biocomposite, biochemical and building material production. These wastes can be classified according to their origin, structure and intended use (Rana et al., 2024). According to their structure, wastes can be divided into two groups: those containing crushed stalks or husks of agricultural products and those consisting of fibrous materials. The fact that they have a honeycomb-like wall structure, formed by the cellular structure organised in the form of capillaries separated by partitions, allows these materials to be used as insulating materials (Gaspar et al., 2020).

In this study, we focus on the use of waste and/or by-products of agricultural crops in the production of environmentally friendly building materials and their importance in terms of bioeconomy. Bioeconomy is seen as key component of consumption and production. The concept of bioeconomy is a path which have various processes that use biological resources by transforming according to consumer preferences. The bioeconomy aims to all the products after their consumption to redesign into new and useful and to make them sustainable. By having challenges as a humanbeing, agricultural wastes in architecture can be morely used in bieoconomical steps.

A Literature Review of Agricultural Wastes Used in Construction Materials

A review of the existing literature reveals several studies that have investigated the use of agricultural wastes and/or by-products in the production of building materials, which are listed in Table 1.

Table 1. *Some agricultural wastes used in construction materials.*

Materials Used	Purpose of Use	References
Wheat and Barley Straw Fibres	As Reinforcement Fibres in Unfired Earth Bricks	(Ashour et al., 2015)
Rice Husk and Sugarcane Bagasse	Biochar for Cement Replacement	(Asadi Zeidabadi et al., 2018)
Flax Boon and Rice Husk	Insulation Materials	(Bakatovich et al., 2018)
Hazelnut Shells	Lightweight Concrete	(Yıldırım et al., 2018)
Rice Husk	High-Performance Earthen Composite Panel	(Antunes et al., 2019)
Corn Husk and Wheat Straw Fibres	Block Type Thermal Insulation Materials	(Rojas et al., 2019)
Unburnt Rice Husk	As Replacement of Cement	(Tunji Lawal et al., 2019)
Rice Husk and Rice Husk Ash	As Aggregate (Rice Husk) and Replacement of Concrete (Rice Husk Ash) in Foam Concrete	(Bayraktar, 2020)
Rice Straw	Building Façade Panels	(Quintana-Gallardo et al., 2021)
Coffee Husk and Sugarcane Bagasse	As Reinforcement in Concrete Blocks	(Souza et al., 2021)
Date Palm Fibres	Acoustic Panels	(Taban et al., 2021)
Rice Husk Ash	As Partial Cement Replacement	(Tariq et al., 2021)
Rice Husk and Rice Husk Ash	As Partial Replacement of Mineral Fine Aggregate and Cement in Bio-Concrete	(Amantino et al., 2022)
Rice Husk Ash	As Partial Cement Replacement	(Bhowmik & Pal, 2022)
Neem Seed Powder	As Cement Replacement in Mortar	(Dharmaraj et al., 2022)
Walnut Shells	Bio-Based Clay Bricks	(El hammouti et al., 2022)
Grape and Cherry Pits	Replacement of Fine/Coarse Aggregate with Fruit Pits	(Grubeša et al., 2022)
Borassus Fibre	As Reinforcement in Production of Earth-Based Bio-Composite	(Mahamat et al., 2022)
Coconut Shell and Rice Husk Ash	Using Coconut Shell as a Replacement for Coarse Aggregate and Rice Husk Ash as a Replacement for Cement	(Sanchaya et al., 2022)
Bagasse and Rice Husk Ashes	As Replacement of Cement in Lightweight Mortar	(Srikanth et al., 2022)
Corn Cob Ash and Sunflower Stalk Ash	As Replacement of Cement	(Șerbănoiu et al., 2022)
Wheat Straw Ash	As Partial Replacement of Cement	(Ul Haq & Sharma, 2022)
Reed Leaves, Reed Stems, Rice Shells, Rice Straws, and Wheat Stems	Filling Material in Hollow Brick Walls	(Xie et al., 2022)

The Use of Agricultural Wastes in Cementitious Composites

Today, the production of cement, one of the basic components of concrete, one of the most popular building materials, consumes a lot of energy and releases high amounts of CO_2 gas into the atmosphere (Singh Rawat & Sharma, 2023). Concrete, an artificial composite material, is basically a mixture of cement, aggregates (fine and coarse) and water. To increase the durability of concrete and reduce permeability, it is common practice to add an appropriate amount of pozzolanic material to Portland cement (Amare et al., 2023). Because of their binding properties, pozzolans are substitutable raw materials for cement. They help to reduce the cost of concrete production and minimise the environmental impact (Singh Rawat & Sharma, 2023).

Natural resources are depleted through the use of non-renewable resources such as natural aggregates (sand and gravel) and water. Natural aggregates (fine and coarse) account for approximately 70-80% of the volume of concrete. The use of solid waste such as palm shells, coconut shells, corn cobs, wood ash, peanut shells instead of natural aggregates in structural and non-structural concrete is being investigated (Boudali et al., 2022). Agricultural wastes such as sugarcane bagasse ash, peanut, oyster shell, rice husk ash and tobacco waste are also used as fine aggregates in concrete due to their pozzolanic properties (Singh et al., 2023). Many studies have been carried out to determine the effect of the utilisation rates of cement and aggregate substitutes on concrete properties. Agricultural wastes such as waste oil palm shells, palm oil fuel ash, waste coconut shells, coconut fibres and waste rice husks and industrial by-products such as bottom ash, slag, flay ash are used in the production of green concrete (Asadi Zeidabadi et al., 2018). Nut shell waste can also be used in certain proportions to replace aggregate and cement in the manufacture of mortar, concrete and bricks (Jannat et al., 2021). In the study by Sanchaya et al. (2022), it was found that the compressive and tensile strength of concrete containing 10% coconut shells instead of coarse aggregate and 5%, 10%, 15%, 20% and 25% rice husk ash instead of cement increased. It was reported that the compressive strength increased by 9.3%, the splitting tensile strength increased by 11.8% and the flexural strength increased by 3% compared to conventional concrete (Sanchaya et al., 2022). The substitution of agricultural waste for aggregates in certain quantities is important in terms of waste disposal, but its effect on the mechanical properties of concrete needs to be investigated (Grubeša et al., 2022). Grubeša et al. (2022) investigated the effect of complete replacement of fine and coarse aggregate with grape or cherry pits on the

properties of hardened concrete. Replacement of aggregate with pits reduced the density and adversely affected the compressive strength. In addition, as the thermal conductivity of the concrete decreased, heat transfer and energy consumption in buildings decreased (Grubeša et al., 2022).

Dharmaraj et al. (2022) conducted a study in which they utilised neem seed powder (NSP) as a partial replacement for cement in various concrete mixtures. The concrete mixtures contained 0%, 5%, 10%, 15%, 15%, 20% and 25% cement by weight. The findings of the study indicated that the maximum strength was achieved with 10% substitution of NSP with cement. It was observed that the compressive strength of NSP cement concrete increased as the curing time increased, and that the strength decreased with higher NSP content. Consequently, it was concluded that as the percentage of NSP increases, the concrete becomes less workable, and therefore additives should be used if 25% is replaced (Dharmaraj et al., 2022). In the study by Souza et al. (2021), the physical, mechanical and thermal properties of concrete blocks were enhanced through the partial replacement of crushed stones with sugar cane bagasse and coffee husks, the most prevalent agricultural by-products in Brazil. The study utilised sugar cane bagasse and coffee husks as substitutes for crushed stone, with proportions ranging from 2.5% to 10% of the total mixture, in addition to a control mix containing no particulate matter. The experimental findings demonstrated that sugar cane bagasse exhibited superior performance as a reinforcement agent when compared with coffee husk. The utilisation of sugar cane bagasse resulted in the production of lightweight concrete blocks that exhibited reduced water absorption, augmented compressive strength, and enhanced thermal properties (Souza et al., 2021).

In order to enhance the properties of conventional cement mortar and cement concrete, chemically or industrially obtained pozzolan admixtures are added to the mix. When these powdered substances are added to the cement, they react with the lime released as a result of the hydration of the cement, thereby strengthening the concrete. The presence of silica and calcium oxide in the rice straw ash has been demonstrated to enhance the workability and strength of the mortar mixture. Specifically, silica has been shown to increase compressive and flexural strength, while calcium oxide has been observed to accelerate hydration (Sudarsan et al., 2023). It has been demonstrated that certain agricultural by-products, characterised by elevated concentrations of silicon dioxide (SiO_2), possess the capacity to enhance the strength and density of concrete. This phenomenon is exemplified by the presence of 80-90% SiO_2 in rice husk ash and over 65% SiO_2 in palm oil fuel ash. The utilisation of these materials has been shown to enhance concrete

properties, including water resistance and lightness (Amare et al., 2023). The presence of silica has been demonstrated to induce a pozzolanic reaction (Sudarsan et al., 2023).

In recent studies, the potential of utilising agricultural or industrial waste ashes with pozzolanic properties as a partial replacement for cement in concrete mixtures has been thoroughly investigated (Alyami et al., 2023; Bayraktar, 2020; Pandya & Bhogayata, 2023; Sanchaya et al., 2022). The utilisation of ashified agricultural by-products has been demonstrated to enhance the strength properties of concrete, thereby improving its pozzolanic reactivity. This improvement is attributed to the higher silica content present in these by-products. For instance, the combustion of sugarcane bagasse results in the production of ash with a high silica content, rendering it a suitable material for use in the production of concrete (Sarangi & Suganya, 2024). Research has demonstrated that certain agricultural by-products, including palm tree husk, coconut husk, rice husk and tobacco waste, can be utilised as aggregates in concrete production, exhibiting satisfactory performance (Shafigh et al., 2014). Rice husk ash, which contains more than 75% silica by weight and has pozzolanic properties, is obtained by burning rice husk. It has been established that this ash, obtained by burning rice husk at temperatures between 550-700 °C, has very good pozzolanic properties due to the formation of amorphous silica (Chen et al., 2024). In the study conducted by Bayraktar (2020), the impact of incorporating rice husk ash and aggregate on the characteristics of foam concrete was examined. The experiment involved the utilisation of raw rice husk as aggregate, with rice husk ash serving as a substitute for cement. The findings indicated that specimens with a high proportion of rice husk exhibited enhanced porosity and a reduction in compressive and flexural strength. The study concluded that these materials can be effectively employed as concrete admixtures (Bayraktar, 2020). In their study, Srikanth et al. (2022) evaluated the mechanical, thermal and environmental performance of mortars developed using bagasse ash (BA) and rice husk ash (RHA) from agricultural waste. Ordinary Portland cement was partially replaced with BA at 0, 5, 15, 20 and 30 wt%, and with RHA at 0, 5 and 15 wt%. The findings of this study demonstrated that utilising agricultural by-products as cement substitutes enhanced the mechanical and durability properties of the resulting mortars. It was observed that incorporating 30% BA as a partial replacement for cement led to a 33% reduction in thermal conductivity. Furthermore, the combination of 15% BA and 15% RHA resulted in a thermal conductivity reduction of up to 31% when compared to conventional mortars (Srikanth et al., 2022).

The utilisation of fibres in mortars or concretes has been demonstrated to enhance the flexural and ductility properties of structures (Lamichhane et al., 2024). Fibres are typically categorised into two broad classifications: natural and synthetic. Natural fibres can be distinguished as either vegetable, animal or mineral based, depending on their provenance. Examples of natural fibres include cotton, flax, hemp, sisal, abaca, banana, ramie, coir, wool, silk and asbestos (Basu et al., 2023). In recent times, researchers have directed their attention towards the utilisation of diverse agricultural by-products as fibre reinforcements in concrete formulations. The employment of natural fibres as reinforcements in cementitious materials constitutes a prevalent practice in sustainable concrete production. The properties of corrosion and fatigue resistance, light weight, biodegradability and abundant availability render fibres a highly favourable alternative (Valizadeh Kiamahalleh et al., 2024). Fibres which exhibit low cost and high strength properties are considered as environmentally friendly agricultural waste (Mishra et al., 2023).

The Use of Agricultural Wastes in Soil-Based Composites

Fibre reinforced blocks are a more economical and sustainable alternative to traditional building materials. A number of studies have been conducted on natural fibres, and the results indicate that earth blocks reinforced with palm, banana, jute, and sugarcane bagasse exhibit improved durability and strength properties to a certain extent (Jesudass et al., 2021). Fibre reinforcement is a frequently employed technique for enhancing the mechanical performance of composites under specific conditions. Mahamat et al. (2022) aimed to develop a biocomposite using a soil-based matrix reinforced with locally produced Borassus fruit fibre, and it was reported that fibre reinforcement positively affected the tensile, flexural and impact strength of the samples by 4.5%, 17.2% and 10%, respectively (Mahamat et al., 2022).

The Use of Agricultural Wastes in Insulation Materials

Agricultural wastes can be used in composite board or panel production due to their high content of lignocellulosic compounds. The type of agricultural waste and the position of the fibres depending on the heat flow affect the thermal conductivity. A number of studies have shown that the insulating properties of natural fibre materials are sensitive to changes in temperature and humidity (Gaspar et al., 2020). While cellulose in the structure of the fibres provides structural integrity, hemicellulose and lignin content supports

the flexibility and durability of the fibre (Ahmed et al., 2025). Plant fibres are environmentally friendly materials known for their superior stiffness and strength-to-weight ratios as well as being renewable and durable. In the construction industry, it is used as reinforcement material in the construction of mortar and unfired earthen blocks and as block type thermal insulation materials (Ramlee et al., 2021).

The potential use of natural fibres as heat and sound insulation materials has been the subject of many studies. Ashour et al. (2015)'s study, it was found that thermal conductivity decreased with increasing fibre content and increased with higher cement and gypsum content when wheat and barley straw were used as fibre reinforcement in unfired bricks. While it was determined that fibre addition contributed positively to both thermal and static properties, the highest thermal insulation values were obtained with fibre bricks reinforced with barley straw (Ashour et al., 2015). Bakatovich et al. (2018) investigated the physical and mechanical properties of thermal insulation materials obtained from plant fibres of various agricultural wastes (rye straw, barley straw, wheat straw, oats straw, rice straw, flax boon and rice husk). The composite material, composed of rye straw and flax boon fibres, was reported to exhibit optimal physical and mechanical properties, in addition to superior thermal insulation properties (Bakatovich et al., 2018). Comparing the mechanical properties of the prototypes obtained using wheat straw and corn husk with expanded polystyrene (EPS), Rojas et al. (2019) pointed out that the block-type samples produced from waste have a good flexural stress. In addition, it was determined that the thermal conductivity values of the samples were close to 0.046 W/mK, which is comparable to other thermal insulation materials such as EPS with a density of 10 kg/m3 (Rojas et al., 2019). In their study, El hammouti et al. (2022) evaluated the thermal effect of walnut shells as an aggregate on unfired clay bricks at 0%, 10%, and 20% levels. Their results indicated that the biocomposites developed using clay and walnut shells improved the energy performance of residential buildings, achieving energy savings ranging from 10.8% to 7.94% in heating and cooling (El hammouti et al., 2022).

Xie et al. (2022) filled hollow bricks with different waste materials such as reed leaves, reed stems, rice shells, rice straws, and wheat stems. The experimental results showed that the insulation performance of hollow bricks filled with agricultural waste increased significantly. Agricultural wastes reduced the total heat transfer coefficient of cavity brick walls by 12.7~32.7%, while the best performance was obtained with rice straw (Xie et al., 2022). In the study by Taban et al. (2021), sound absorbing panels of different thicknesses (25, 35, 45 and 55 mm) and densities (125 and 175 kg/m3) were

produced from palm fibres and the acoustic performance of the material was evaluated. As a result of the acoustic measurements, it was determined that the waste palm fibre material showed good acoustic performance (Taban et al., 2021). Quintana-Gallardo et al. (2021) investigated the environmental, thermal and acoustic performance of façade panels produced using waste rice straw. It is reported that the façade using rice straw panels provides adequate thermal insulation by reducing the thermal transmittance of the conventional double-layer brick façade by 50% and shows adequate hygrothermal and acoustic performance. In terms of life cycle assessment, the low environmental impact of the façade using rice straw has also been proven (Quintana-Gallardo et al., 2021).

Conclusions and Recommendations

Nowadays humanbeing has a deep challenge to make the resources to be sustainable because of the climate change, water scarcity, food shortages. Bioeconomy accepted as to an effective way to find new solutions the wastes into new products. In this study, the wastes of the agricultural products in architecture tried to be analyzed by using their contrubitions in a bioeconomical approach.

The utilisation of waste materials contributes to both reducing the total cost of traditional building materials and preventing environmental pollution. Many studies have evaluated the use of agricultural wastes as partial cement and aggregate substitutes in concrete. By using them as partial substitutes for aggregates, cement and pozzolan in concrete and mortar production, lighter and lower density materials can be obtained. It was found that the mechanical properties of mortars were positively affected and thermal conductivity decreased. The wastes used in brick production increase the strength of the material and reduce the weight of the material. By-products of various fruits, especially shells, can be used in the development of bio-based composites. Blocks and panels using waste fruit shells and fibres attract attention with their thermal and acoustic properties.

Agricultural waste is an attractive raw material source due to its abundance, accessibility, natural and renewable characteristics, environmental friendliness, non-toxic properties, low thermal conductivity, and high specific heat. However, properties such as low resistance to various effects, being affected by moisture and fire, not having a homogeneous structure and insufficient strength limit the use of these materials (Balador, 2024). Although these properties vary according to the type of waste, more extensive experimental studies are required to determine the physical, chemical and

mechanical properties of agricultural wastes. These studies will enable the new building materials to be developed to take their place in the market as an alternative to traditional materials that are widely used today and whose harmful environmental effects are known.

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CHAPTER 7

SUSTAINABLE TRANSFORMATION AND ORGANIZATIONAL AGILITY IN BUSINESSES

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Abstract

This study explores in-depth how sustainable transformation and organizational agility, as two complementary concepts, can be integrated within businesses. Sustainable transformation encompasses not only environmental responsibilities but also social, economic, and financial sustainability principles, highlighting the potential for long-term value creation. This transformation involves reducing environmental impacts, utilizing resources efficiently, and enhancing societal benefits, while also aiming to achieve a competitive advantage. Organizational agility, on the other hand, refers to a business's ability to adapt quickly to changing market conditions and consumer demands, develop innovative solutions, and maintain flexibility. The combination of these two concepts enables businesses to grow in a more resilient, innovative, and sustainable manner. In this context, a strategy is proposed for businesses to meet their environmental responsibilities while simultaneously enhancing their economic sustainability, laying stronger

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foundations for the future. Ultimately, this study provides businesses with a comprehensive approach to guide them towards a sustainable and agile future, offering strategic recommendations on how challenges encountered in this process can be turned into opportunities. Such a transformation aims not only for environmental and economic success but also for societal contributions.

Keywords: Sustainable Transformation, Sustainability, Transformation, Organizational Agility, Agile Leadership, Agility.

Introduction

Researchers from energy and environmental economists to scientists in different fields are conducting various studies on sustainable transformation and organizational agility in businesses. Especially regarding climate change and depletion of natural resources, some examine the determinants of carbon emissions and other elements of greenhouse gas emissions, while others investigate the most effective ways to mitigate climate change. Each of these efforts has been brought together as "climate action and sustainable development goals" within the framework of the United Nations Sustainable Development Goals (SDGs). In addition to factors such as gross national income per capita, economic liberalization policies, urbanization, financial development, energy use and industrialization, the agile organizational structure of economic units and their ability to adapt to changing conditions and ensure sustainability are fundamentally examined. Following the Paris Agreement and other global agreements, countries have turned to investing in green energies and supporting the development of these energies in order to increase their national contributions (Yazıcı et al., 2025: 2-10). In this context, the relationship between sustainable transformation and organizational agility in businesses plays a critical role in combating climate change. Adopting sustainable practices and rapidly adapting to changing conditions will contribute to achieving environmental goals and economic success. This study aims to investigate how sustainable transformation in businesses can be supported by organizational agility, the challenges and opportunities of this relationship.

1. Sustainability

Today, all countries in the world are showing increasing sensitivity to sustainable environment, sustainable economy and sustainable social life. Sustainable development represents an understanding of development that is respectful to the environment and human rights, and is economically

and socially fair, taking into account the needs of future generations. This approach includes basic goals such as ending poverty, combating climate change, protecting oceans and forests, improving health and education, reducing inequality and encouraging economic growth. These principles set forth by the United Nations are being accepted internationally and implemented and adopted in economic life every day. In order to ensure sustainability, businesses need to operate in a way that protects the rights of future generations, the environment and ecosystems, ensures economic stability and increases social justice and welfare. They should also operate in accordance with human rights and provide a sustainable economic life by establishing working standards (Bayram and Öztırak, 2023:126). The linear economic model, which focuses on constantly providing new resources and ignores the reuse of waste and used products, leads to significant environmental consequences such as environmental pollution, increased greenhouse gas emissions, destruction of natural life and depletion of resources. This linear model, which causes climate change and environmental pollution, causes the degradation of ecosystems. Due to these features, it is actually an unsustainable economic system. However, sustainable development establishes the basis for a more livable future by determining the protection of resources, reduction of waste and protection of the environment as priority goals (Grund et al., 2024). In 2015, the United Nations Commission on Sustainable Development defined sustainability with social, environmental, economic and institutional indicators in the Sustainable Development Program (UNDP) and determined 17 sustainable development goals for the well-being of humanity. This program, which includes a wide range of goals from ending poverty to climate action, from reducing inequalities to creating sustainable cities, has been accepted at the international level. In this regard, the European Union has prepared a large-scale action plan for the circular economy, drawing a roadmap covering the structural and technological changes necessary for the transition to a sustainable economy by 2050, and has proposed the implementation of circular economy principles at every stage from the design of products to their consumption with an "Action Plan for the Circular Economy". In addition, the Zero Waste project aims to achieve sustainability goals with practices such as reducing packaging waste and prioritizing green products in public procurement (Orieno et al., 2024; Bayram, 2023: 2-4). We can examine the concept of sustainability in three important areas. These are environmental sustainability, social sustainability and economic sustainability.

1.1. Environmental Sustainability

Environmental sustainability is a multifaceted approach that aims to rationally use and manage natural resources, protect and restore ecosystems, and reduce environmental pollution. The goal is to improve the quality of life of current generations without compromising the ability of future generations to meet their needs (Hunjra et al., 2024). The basis of this approach is to maintain the ecological balance, support biodiversity, and find solutions to global problems such as climate change. Protecting natural resources alone is not enough; progress is needed in line with economic development and social justice (Istrate et al., 2024). Therefore, the development of sustainable policies and practices requires cooperation and a sense of shared responsibility among states, companies, and individuals (Chaban et al., 2024). Environmental sustainability includes various strategies such as increasing energy savings, supporting the use of renewable energy sources, improving waste management systems, adopting sustainable agricultural methods, and investing in environmentally friendly technologies. In addition, environmental impact assessments, implementation of environmental protection laws and increasing environmental awareness of society are also vital for a sustainable future. It not only provides solutions to environmental problems, but also has the potential to build a more sustainable and livable world in the long term by increasing economic growth, social welfare and global competitiveness (Raihan, 2024). Sustainability in the use of natural resources forms the basis of the understanding of environmental protection and necessitates the careful and conscious management of these resources. The consumption of resources such as water, soil, minerals and energy should be in a balance that will meet the needs of today and the future. It is important to apply the principles of recycling, re-evaluation and circular economy to use resources efficiently (Bayram, 2024). In particular, in order to prevent the rapid depletion of limited resources and to minimize environmental damage, approaches that prioritize resource efficiency should be adopted in all life processes, starting from the design of products. In this way, resources can be used for a longer time, the amount of waste is reduced and negative impacts on the natural environment can be mitigated. Conscious use of resources also helps companies to get ahead in competition by reducing their expenses and to increase the quality of life of society.

Waste management is of vital importance for an environmentally sensitive future. This process includes reducing the amount of waste, reusing waste, recycling it and disposing of it without harming the environment. Today, increasing consumption habits and increasing population cause a

continuous increase in the amount of waste, which leads to the depletion of natural resources and increased environmental pollution. Therefore, waste management approaches should aim to prevent waste generation as much as possible, see waste as a resource and dispose of it without harming the environment. In particular, recycling and reusing waste provides great benefits in protecting natural resources, saving energy and reducing greenhouse gas emissions. In addition, advanced technologies should be used to reduce the negative effects of landfills and incineration facilities on the environment and the carbon footprint should be reduced (Demastus and Landrum, 2024).

Carbon footprint refers to the total greenhouse gases emitted into the atmosphere as a result of a product, service or individual's activities and is a critical criterion in combating climate change. Carbon footprint takes into account gas emissions from various activities such as energy use, transportation, production processes and waste management. Various methods such as increasing energy efficiency, using renewable energy sources, improving transportation systems and reducing carbon-intensive production methods should be implemented to reduce greenhouse gas emissions. In addition, changing individual consumption habits plays an important role in reducing carbon footprint. Reducing carbon footprint is vital to mitigating the harmful effects of climate change and achieving a more sustainable future. Therefore, companies, governments and individuals should track and measure their carbon emissions and take various measures to achieve reduction targets.

1.2. Social Sustainability

Social sustainability encompasses processes and structures that support the long-term well-being, equity and resilience of a society. It aims to meet people's basic needs, ensure equality, create a society that embraces everyone and protect cultural differences. It aims to protect the social, cultural and economic rights of not only today but also future generations. Therefore, it is very important to develop and implement policies that provide equal opportunities for everyone in issues such as education, health, employment opportunities, housing and social security. At the same time, empowering local people, encouraging civil society organizations to take an active role and ensuring social harmony are also fundamental elements of social sustainability (Zarauz et al., 2024). Social sustainability is also an important area of responsibility for companies. Respecting employee rights, providing fair working conditions, valuing differences, investing in local people and supporting social responsibility projects are ways to contribute to social sustainability. In addition, managing social risks in the supply chain,

preventing human rights violations and being transparent are also elements that increase the social sustainability performance of companies. In addition to being a moral imperative, it also helps companies to stay ahead of the competition by strengthening their reputation, increasing customer loyalty, and attracting talented employees (Zafar et al., 2024).

Employee rights are one of the cornerstones of social sustainability and aim to protect the right of every employee to a fair, safe, and respectful work environment. These rights include protection against discrimination, equal pay, safe working conditions, freedom to form a union, the right to collective bargaining, reasonable working hours, and adequate rest periods. It is a requirement of companies' social responsibility to respect employee rights and act in accordance with international norms. Protecting employee rights is not only an ethical imperative, but also increases productivity, increases employee motivation, reduces turnover, and strengthens the company's reputation. Therefore, companies' efforts to protect and improve employee rights are an important part of a sustainable business structure (Garlock et al., 2024).

Providing benefits to society is an important aspect of social sustainability by leaving positive impacts on the regions where companies are located. It can be implemented in different ways, such as stimulating the local economy, supporting education and health services, participating in social responsibility projects, sponsoring cultural events or helping disadvantaged groups. The contribution of companies to society not only provides social benefits, but also increases the company's reputation, strengthens its ties with society, increases employee motivation and supports its sustainability in the long term. Therefore, it is an approach that provides mutual benefits for society and the company for companies to understand the needs of society in accordance with ethical values and make conscious investments towards these needs (Alkhwaldi, 2024). Ethical values are the basic rules that ensure that companies adhere to principles such as honesty, openness, justice and responsibility in all their work and are an integral part of social sustainability. Ethical values require not only complying with the law, but also exhibiting behaviors that are in line with moral values, social rules and the expectations of the relevant people. Compliance with ethical values helps companies establish trusting relationships with employees, customers, suppliers, investors and society. Ethical behavior manifests itself in various issues such as preventing bribery, managing conflicts of interest, protecting the confidentiality of information and adopting environmentally friendly practices. Adherence to ethical values helps companies to be sustainable in the long term, protects their reputation and gains the trust of the relevant

people and enables them to get ahead in the competition (Bayram and Öztırak, 2023:125-226).

1.3. Economic Sustainability

Economic sustainability is the capacity of a system, company or society to use its economic resources effectively in the long term, to maintain its welfare and to continue its development. Economic sustainability includes not only maximizing short-term profits but also protecting natural resources, ensuring social justice and ensuring the economic opportunities of future generations. Balanced economic growth can be built on the wise use of resources, technological developments, competitive markets and a solid financial structure. At the same time, the ability of companies and societies to adapt to changing economic conditions, manage risks and be resilient to difficult situations is also an important part of economic sustainability (Shah, 2024).

Economic sustainability means creating value for companies in the long term, maintaining competitiveness and meeting the expectations of relevant people. In order for companies to achieve sustainable economic success, they need to increase efficiency, reduce costs, develop innovative products and services, manage risks and adopt sustainable business models. In addition, the economic sustainability of companies is also affected by factors such as supply chain management, ethical behavior, transparency and social responsibility. Economic sustainability is crucial not only for the success of companies, but also for the well-being of society and global economic stability (Paull, 2024).

Long-term value creation is an approach that aims to provide sustainable and lasting benefits for all interested parties, rather than focusing on companies' short-term profit goals. This is achieved through various methods, such as protecting natural resources, reducing environmental damage, participating in social responsibility projects, looking after employee well-being, increasing customer satisfaction and encouraging innovation. Long-term value creation strengthens companies' reputations, increases brand value, increases customer loyalty and attracts talented employees. In addition, companies that think long-term gain competitive advantage by adapting more easily to changing market conditions and environmental challenges. For this reason, long-term value creation is the basis of a sustainable business model and is vital for companies' future success (Alhammadi, 2024).

Risk management is the process of identifying, evaluating and controlling potential risks and opportunities that may affect companies' businesses.

This process covers various areas such as financial risks, operational risks, strategic risks, legal risks, environmental risks and social risks. A good risk management strategy allows companies to be prepared for unexpected events, minimize losses, ensure the continuity of their business and get ahead of the competition (Karvounis et al., 2024). Risk management not only prevents bad events, but also increases the growth potential of companies by improving opportunity assessment and decision-making processes. Therefore, risk management is an indispensable part of a sustainable business model and is vital for the long-term success of companies.

1.4. Sustainable Transformation in Businesses

Sustainable change in companies is the process of reorganizing the activities, products and services of institutions by taking into account environmental, social and economic factors. This change aims not only to reduce environmental damage, but also to create long-term economic value, support social justice and increase the well-being of all concerned. Sustainable change requires questioning existing business models, processes and technologies, finding innovative solutions and aligning the corporate culture with sustainability principles. In this process, it is important for companies to take various steps such as reducing their environmental impact, increasing energy efficiency, improving waste management, protecting natural resources and creating sustainable supply chains (Ullah et al., 2024). Sustainable change allows companies to get ahead in competition, strengthen their reputation, increase customer loyalty and attract talented employees by simply increasing their operational efficiency. With the increasing demand of consumers for sustainable products and services, sustainability has become a strategic necessity for companies. In addition, investors and financial institutions are including sustainability performance in their evaluation processes and allocating more resources to sustainable companies. Therefore, sustainable change is critical to the future success of companies (Grunwald et al., 2024). The sustainable change process is shaped by the interaction of various factors such as leadership, vision, strategy, innovation, collaboration, and continuous improvement. In order for companies to achieve their sustainability goals, the commitment of top management, the participation of employees, collaboration with relevant people, setting measurable goals, and monitoring progress are important (Tan, 2024). Sustainable change is not just a project or program, but a continuous learning and development journey that should be embedded in the structure of the entire organization. In this journey, companies need to integrate sustainability principles into all

decision-making processes and constantly seek new opportunities in order to be successful.

2. Organizational Agility

Organizational agility can be defined as the ability of an organization to adapt to rapidly changing market conditions, customer expectations and technological developments, and to produce flexible and innovative solutions. In order for an organization to have agile characteristics, it would be appropriate to adopt more adaptable, independent and collaborative working models instead of traditional hierarchical structures. Organizational agility provides the organization with a proactive approach to predict and be prepared for future changes. Organizational agility includes continuous learning, experimentation, feedback and adaptation processes (Soomro, 2024). Organizational agility provides businesses with various benefits such as competitive advantage, customer satisfaction, employee loyalty and operational efficiency. Agile organizations can launch new products and services more quickly, respond better to customer needs, increase employee creativity and motivation and reduce operational costs. In addition, agile organizations can better cope with uncertainty and complexity, respond more quickly to crises and ensure their long-term sustainability. Developing organizational agility will be possible by harmoniously managing various factors such as leadership, culture, processes and technology. Agile leaders are leaders who empower employees with their visionary characteristics, encourage collaboration, and lead change (Ly, 2024). In an agile culture, there are characteristics such as transparency, trust, learning, and experimentation. Agile processes can be iterative, flexible, and customer-focused. Agile technologies can automate business processes, facilitate data analysis, and strengthen communication. Organizational agility is not just a project or program, but a continuous transformation journey that must be embedded in the structure of the entire organization.

2.1. Agile Leadership

Agile leadership is a leadership style that is necessary to be successful in today's rapidly changing and complex business environments. Unlike traditional hierarchical leadership, agile leadership supports flexibility, adaptability, and continuous learning at every level of the organization. Agile leaders are leaders who have a clear vision, empower employees, and create learning institutions that ensure continuous improvement. This approach aims to transform not only the behavior of leaders, but also the culture,

processes, and structure of the organization. Agile leaders' visionary and empowering employees and creating learning institutions will enable them to develop successful management processes (Atobishi et al., 2024). Visionary leadership is a fundamental part of agile leadership and refers to setting a clear and inspiring goal for the future. Agile leaders are visionary, clearly stating where the organization should go, understanding the expectations of the relevant people, and foreseeing the opportunities that change will bring. This vision can guide employees, increase their motivation, and unite them around a common goal. Agile leaders can shape the strategic decisions of the organization by evaluating not only the current situation but also future possibilities (Bayram and Öztırak, 2023).

Empowerment means that leaders give employees the authority to make decisions, assign responsibility and allow them to realize their own potential. Empowered employees can be more willing, creative and productive. Agile leaders trust their employees, support them and provide opportunities for their development. Empowerment will not only increase individual performance but also strengthen the organization's overall agility and adaptability (Öztırak, 2023).

Learning institutions are one of the tasks that agile leadership will fulfill and are used in the sense of having the ability to constantly acquire new information, learn from experiences and improve themselves. Learning institutions can encourage transparency, collaboration, feedback and continuous improvement. By creating learning institutions, agile leaders can support employees' knowledge sharing, problem-solving skills and innovation. Learning institutions can adapt more quickly to changing market conditions and technological developments, get ahead of the competition, and ensure their long-term sustainability (Zeid et al., 2024).

2.2. Agile Management Methodologies

Agile management methods are approaches that enable projects to be completed more quickly, flexibly and efficiently in today's dynamic and competitive business environments. Unlike traditional project management methods, agile methods exhibit features such as adapting to change, being customer-focused and prioritizing teamwork. Scrum, Kanban and Lean Manufacturing are the most popular and effective examples of agile management methods. These methods help businesses manage their projects better, exceed customer expectations and get ahead of the competition (Amajuoyi et al., 2024). Scrum is an agile management framework widely used especially in software development projects. Scrum adopts an iterative

and incremental approach, projects are planned in short sprints (usually 2-4 weeks) and a working product part is delivered at the end of each sprint. The Scrum team consists of the product owner, Scrum master and development team, and each role has specific responsibilities. Scrum is based on the principles of transparency, control, and adaptation, and encourages communication and collaboration through regular meetings (daily Scrum, sprint planning, sprint review, and sprint retrospective) (Saleh et al., 2024).

Kanban is an agile management method that aims to visualize workflow, balance workload, and continuously improve. Kanban shows which stage the work is in and who is responsible by using cards representing work items on a board. Kanban balances workload and eliminates bottlenecks by limiting the start and finish of work. Kanban prioritizes flexibility and adaptation and can be used with any project management method (Singh et al., 2024).

Lean Manufacturing is a management philosophy that aims to eliminate waste, increase efficiency, and maximize customer value. Lean Manufacturing was developed with inspiration from the Toyota Production System (TPS) and aims to eliminate unnecessary steps, waiting, transportation, stocks, and errors in production processes. In Lean Manufacturing, various tools and techniques are used, such as continuous improvement (Kaizen), just-in-time manufacturing (JIT), value stream mapping (VSM), and 5S. Lean Manufacturing is a method that can be applied not only in production processes, but also in the service sector, software development projects, and other business areas (Anifa et al., 2024). Agile management methods help businesses manage their projects more effectively, increase customer satisfaction, and get ahead in the competition. Businesses can adapt and combine these methods according to their own needs and the characteristics of their projects. The important thing is to be able to implement the features of continuous learning, encouraging collaboration, and being open to change by adopting agile principles.

2.3. Data-Based Decision Making

Data-based decision making is when companies base their strategic and operational decisions on solid data, analysis, and evidence. This approach aims to avoid impulsive decisions, make objective assessments, and achieve more informed, effective, and sustainable results. Data-based decision making is crucial for improving company performance, reducing risks, increasing customer satisfaction, and getting ahead of the competition (Ansari et al., 2024).

The basic steps of the data-based decision making process are measurement, monitoring, and continuous improvement. Measurement is the process of collecting, analyzing, and creating meaningful metrics to evaluate company performance. Setting measurable goals is important for determining how performance will be monitored and evaluated. Monitoring is the process of regularly monitoring set metrics, comparing performance with goals, and identifying deviations. Monitoring helps companies understand where they are successful and where they need to improve (Castillo and Monoso, 2024).

Continuous improvement is the process of continuously improving companies' processes, products, and services based on the results of measurement and monitoring. Continuous improvement includes various activities such as problem solving, innovation, learning and adaptation. Continuous improvement helps companies increase their efficiency, reduce costs, increase customer satisfaction and get ahead of the competition. Data-based decision making enables companies to be smarter, more agile and more sustainable (Smolyakov and Bahrami, 2024). In order for companies to develop a data-based decision-making culture, it is important to invest in data collection and analysis infrastructure, increase employees' data literacy, encourage transparency and collaboration and constantly receive feedback based on data analysis. Data-based decision making is not just a method or process, but a culture that changes the mindset and behavior of companies.

2.4. Collaboration and Partnerships

Collaboration and partnerships are an important part of achieving lasting success in today's business world. Due to the increasing competition and complexity of global markets, companies have difficulty overcoming all the challenges on their own. Therefore, establishing collaboration and partnerships in areas such as supply chain management and stakeholder relations provides companies with various benefits such as competitive advantage, increased efficiency, risk reduction and innovation. Supply chain management is a complex network that covers all the processes from the production of a product or service to its delivery to the consumer. This network includes various parties such as suppliers, manufacturers, distributors, retailers and customers. Effective supply chain management requires collaboration, coordination and information sharing among all these parties. By establishing trust-based relationships with their supply chain partners, companies can reduce costs, shorten delivery times, increase quality and increase customer satisfaction. In addition, adopting sustainability practices together with their supply chain partners helps them fulfill their environmental and social responsibilities (Desbureaux et al., 2025). Stakeholder relations refer to the relationships a

company has with all individuals or groups (employees, customers, suppliers, investors, governments, civil society organizations, and local communities) who are affected by its activities or who can affect the company. Successful stakeholder management requires understanding the needs and expectations of all these groups, communicating openly and transparently with them, considering common interests, and resolving disputes. By establishing good relationships with stakeholders, companies can strengthen their reputation, increase brand value, increase customer loyalty, attract talented employees, and ensure long-term sustainability (Inês et al., 2025). Collaboration and partnerships offer significant opportunities not only for large companies but also for small and medium-sized enterprises (SMEs). By collaborating, SMEs can pool their resources, expand their access to markets, invest in technological innovations, and increase their competitiveness. In addition, SMEs can partner with large companies to be included in supply chains, expand into new markets, and gain knowledge (Thatchenkery and Piezunka, 2025). Collaboration and partnerships help companies become more competitive, more innovative and more sustainable. Companies can achieve long-term success by collaborating and partnering on issues such as supply chain management and stakeholder relations. Therefore, it is important for companies to adopt a culture of collaboration and partnership and make strategic investments in this direction.

2.5. Benefits of Organizational Agility to Businesses

Organizational agility provides businesses with significant advantages in today's rapidly changing business world. Unlike traditional, hierarchical structures, agile organizations stand out with their flexibility, adaptability, and rapid decision-making processes. In this way, they become more resilient to sudden changes in market dynamics, technological developments, and unexpected crises. Organizational agility enables businesses not only to survive, but also to get ahead in competition, increase customer satisfaction, and achieve sustainable growth (Jaafar, 2025).

Quick adaptation to changing market conditions is one of the most important benefits of organizational agility. Today, technological developments, globalization, and changes in consumer behavior are constantly transforming markets. Agile organizations can recognize these changes in advance, analyze them quickly, and adapt by developing flexible strategies. In this way, they can evaluate new opportunities, eliminate threats, and maintain their competitive advantage. Rapid adaptation can enable businesses not only to survive, but also to rise to a leading position in the market. Instead of resisting change, agile organizations see it as an

opportunity and constantly produce new ideas, experiment and learn. This will enable them to be more innovative, more customer-focused and more successful than their competitors in the market (Shaikh, 2025).

Paying attention to customer needs is another important benefit of organizational agility. Agile organizations listen to their customers, take their feedback into account and continuously improve their products and services. This not only increases customer satisfaction but also strengthens customer loyalty. Agile organizations can quickly develop new products and services to meet the changing needs and expectations of their customers. Agile organizations encourage creativity, support risk-taking and enable employees to produce new ideas. In this way, businesses can gain competitive advantage in the market, enter new markets and achieve long-term growth. Agile organizations can meet the needs of their current customers, predict their future needs and innovate in advance (Razzak et al., 2025).

Organizational agility increases employee participation and motivation, creating a more creative, innovative and productive workforce. Agile organizations give their employees more responsibility and authority, encourage collaboration and create learning environments. Thus, employees feel more valued, are more committed to their work and contribute more to the success of the organization. Agile organizations value the thoughts of their employees and ensure that they are involved in activities, thus strengthening their commitment to the organization. Increasing efficiency and competitiveness are tangible results of organizational agility. Agile organizations improve their processes, use their resources more efficiently and eliminate unnecessary processes. This reduces costs and enables products and services to be launched more quickly. Agile organizations gain an advantage over their competitors by being more flexible, faster and more innovative in a competitive environment (Panda, 2025). High efficiency and competitiveness allow businesses to increase their market share, increase their profits and achieve long-term growth. Agile organizations can quickly adapt to changing market conditions, seize new opportunities and eliminate threats, which helps them maintain their leadership position in the market and achieve sustainable success.

3. Sustainable Transformation and Organizational Agility in Businesses

Developing and implementing sustainability strategies is the process of integrating environmental, social and economic responsibilities into the way businesses do business, their activities and decision-making processes.

This means creating value in the long term, meeting the expectations of the people involved and considering the needs of future generations, rather than focusing solely on short-term profit goals. Sustainability strategies help businesses reduce the damage they cause to the environment, use resources more efficiently, exhibit honest behavior, protect employee rights and benefit society. It is important that these strategies are compatible with the vision, mission and values of the business and are adopted by all employees (Probojakti et al., 2025). Creating and disseminating an agile structure is a process that enables businesses to become flexible, adaptable, collaborative and learning organizations. This requires encouraging more independent teams, open communication, rapid decision-making and continuous development instead of traditional hierarchical structures. An agile structure increases the creativity, desire and participation of employees, strengthens customer focus and allows businesses to adapt more quickly to changing market conditions. The dissemination of agile structure includes various steps such as managers setting an example, training employees, using appropriate processes and tools, and celebrating successes (Suryani and Dwiputra, 2025). Sustainable product and service design is an approach that aims to reduce the environmental damage caused by products and services, increase the benefits they provide to society, and create economic value. This includes minimizing the environmental damage caused by products throughout their life cycle (from raw material procurement to production, use, and disposal), reducing energy and water consumption, preventing waste generation, and using recyclable materials. Sustainable service design aims to reduce the impacts on the environment and society during the provision of services, use resources more efficiently, and ensure customer satisfaction. Sustainable product and service design helps businesses to get ahead of the competition, increase customer loyalty, and contribute to a sustainable future (Satar et al., 2025). Sustainable supply chain management is an approach that aims to manage environmental and social risks in businesses' supply chains, increase transparency, and promote sustainable practices. This includes considering environmental and social criteria when selecting suppliers, monitoring suppliers' sustainability performance, collaborating to drive improvements, and ensuring that all stakeholders in the supply chain respect human rights. Sustainable supply chain management helps businesses protect their reputation, reduce risks, lower costs, and create a sustainable value chain.

4. Challenges and Opportunities That Businesses May Face in the Process of Sustainable Transformation and Organizational Agility

While sustainable change and organizational agility are important strategies that provide long-term success and competitive advantage for businesses, it is inevitable to encounter various obstacles in this process. Overcoming these obstacles and evaluating opportunities is crucial for businesses to successfully move towards a sustainable future. While obstacles usually arise from reasons such as internal resistance, lack of resources, lack of information and complex stakeholder relationships, opportunities arise in areas such as innovation, increased productivity, increased brand value and entry into new markets.

4.1. Challenges That Businesses May Encounter in the Process of Sustainable Transformation and Organizational Agility

Internal Resistance and Cultural Change: Sustainability and agility bring with them significant cultural changes that require businesses to question their current ways of doing business, values, and beliefs. Changing employees' habits, learning new skills, and adopting a different mindset can take time and may be met with resistance. In particular, the ability of leaders to lead change and motivate employees is critical to the success of this process (Rocha et al., 2025).

Resource Constraints and Investment Requirement: Sustainable transformation and agility practices often require significant investments at the beginning. Investing in new technologies, training employees, redesigning processes, and developing sustainable products can be costly. Financing such investments can be challenging, especially for small and medium-sized enterprises (SMEs) (Saragih et al., 2025).

Lack of Knowledge and Need for Expertise: Sustainability and agility issues are constantly evolving and complex areas. It is important for businesses to have sufficient knowledge and expertise on these issues, develop the right strategies, and implement effective practices. However, many businesses do not have sufficient knowledge about sustainability and agility and may have to seek support from external sources (Khan and Kwan, 2025). Complex Stakeholder Relationships: Businesses are involved with various stakeholders such as suppliers, customers, employees, investors, governments and civil society organizations. Sustainability and agility

practices require considering the expectations of all these stakeholders and collaborating with them. However, different stakeholders may have different priorities and expectations, which can complicate the decision-making processes of businesses (Rauniar and Cao, 2025).

4.2. Opportunities that Businesses May Encounter in the Process of Sustainable Transformation and Organizational Agility

Innovation and Competitive Advantage: Sustainability and agility encourage businesses to develop new products, services, processes, and business models. This helps businesses gain competitive advantage, enter new markets, and increase customer loyalty. In particular, businesses that offer environmentally friendly products and services may attract the attention of increasingly environmentally conscious consumers (Bennett et al., 2025).

Increased Efficiency and Cost Savings: Sustainability practices help businesses reduce energy consumption, improve waste management, protect water resources, and use resources more efficiently. This allows businesses to reduce operational costs, increase profitability, and increase competitiveness. Agile management methodologies increase efficiency by optimizing processes, balancing workload, and strengthening communication (Mukhsin et al., 2025).

Increased Brand Value and Strengthened Reputation: Businesses that exhibit sustainable and ethical behavior are perceived as more trustworthy and respected by consumers, investors, and other stakeholders. This increases the brand value of businesses, strengthens their reputation and increases customer loyalty. In particular, businesses that participate in social responsibility projects and operate transparently gain the appreciation of society (Mueller-Saegebrecht and Walter, 2025).

Entry into New Markets and Growth Potential: Sustainability trends create new markets and growth opportunities for businesses. For example, the renewable energy sector, organic agriculture, recycling industry and environmentally friendly products market are growing rapidly. Agile organizations can quickly enter these new markets, offer innovative products and gain competitive advantage (Rawashdeh et al., 2024).

Sustainable transformation and organizational agility are complex processes that present both challenges and opportunities for businesses. In order for businesses to successfully manage this process, it is important for them to focus on factors such as leadership, vision, strategy, collaboration and

continuous learning. Overcoming challenges and evaluating opportunities will enable businesses to successfully move towards a sustainable future.

Conclusion, Discussion and Recommendations

Sustainable change and corporate agility in businesses have become not only a choice but a necessity in the complexity and uncertainty of today's business world. Both sustainability and agility not only offer businesses the opportunity to fulfill their environmental and social responsibilities, but also support economic success and long-term value creation. The strong relationship between sustainable change and corporate agility enables businesses to quickly adapt to changing market conditions and adapt to these changes while also considering social and environmental values. This helps businesses gain competitive advantage, increase brand value and increase productivity (Marjerison et al., 2022). However, there are also challenges that businesses will face in sustainable change and corporate agility processes. In particular, managers need to lead the change, involve employees in the process, allocate appropriate resources and encourage a culture of collaboration. In addition, it is of great importance to adopt agile management approaches for the effective implementation of sustainability strategies. Agile management enables businesses to make fast decisions, act flexibly and produce innovative solutions. However, this process can only be successful if businesses can direct their resources correctly and develop a culture based on continuous learning.

Discussion

The integration of sustainable change and organizational agility offers significant opportunities for businesses. However, the challenges encountered while evaluating these opportunities should not be ignored. These challenges may include obstacles such as change processes that employees resist, leaders who do not have sufficient knowledge and skills, and organizational structures that are not suitable for agility. In order to overcome these obstacles, leaders need to determine a strong vision, create open communication channels, and include employees in this process. In addition, the integration of agility and sustainability not only enables businesses to fulfill their environmental responsibilities, but also strengthens their relationships with society and increases corporate reputation.

Recommendations

In order for businesses to be successful in sustainable change and agility processes, it is of great importance for leaders to lead the change and adopt an effective agile leadership approach. Leaders should increase the motivation of employees and provide them with a vision throughout the process, ensuring that the change is directed (Probojakti, 2025). In addition, the active involvement of employees in the process is a critical factor for the success of change management. Businesses should value their employees' ideas, receive their contributions, and thus reduce possible resistance to change. Adopting agile management methods allows businesses to make quick decisions and adapt quickly to changing conditions. These methods increase organizational flexibility and encourage the emergence of innovative solutions. In addition, it is important to allocate resources correctly and use them efficiently in sustainable change processes. Optimization of business processes and adoption of digitalization strategies allow for more effective use of resources (Pelletier et al., 2025). In order for businesses to gain competitive advantage in sustainable change and agility processes, they need to adopt a culture of continuous learning and innovation. This approach will enable businesses to gain a stronger position in dynamic market conditions. Finally, by establishing strategic alliances and external collaborations, businesses can implement sustainability and agility strategies more effectively and develop innovative solutions. Such collaborations allow for more efficient use of resources and enable businesses to establish stronger relationships with external stakeholders (Ononiwu et al., 2024). As a result, integrating sustainable change and corporate agility strategies will not only ensure that businesses fulfill their environmental and social responsibilities, but also their long-term economic success. This process will provide businesses with new opportunities and move them towards a more resilient, innovative and sustainable future. Such a transformation will make a significant contribution not only to businesses themselves, but also to society and economic life.

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